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Side and Main Rod Work

By L. C. Morrow

Managing Editor, *American Machinist*

Sequence of operations performed in the West Albany shops of the New York Central—A very efficient air-operated fixture used in machining rod brasses

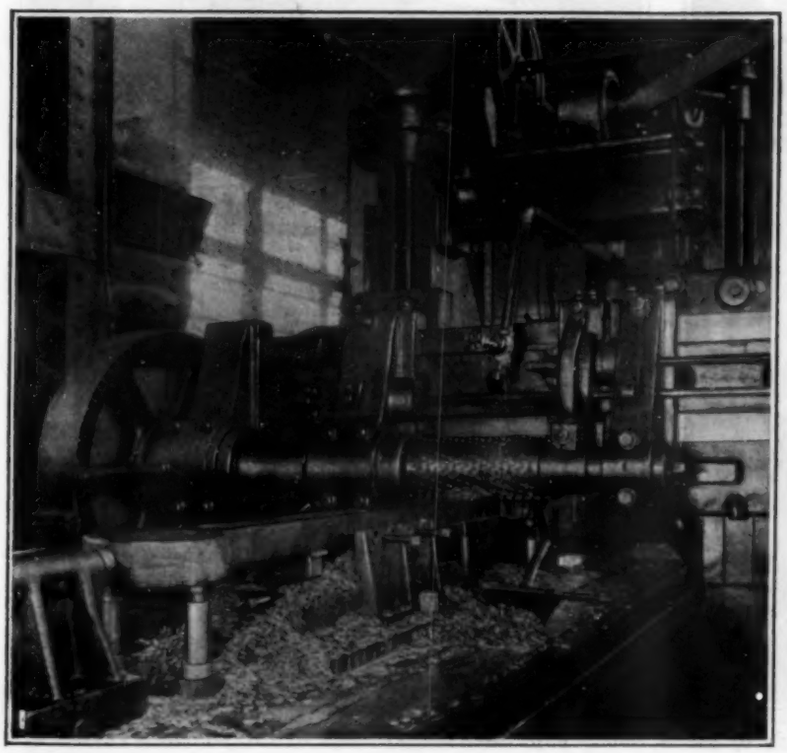
THERE is a similarity of methods on side- and main-rod work in almost all railroad shops, and many of the methods employed by the West Albany shops of the New York Central have been described except as to some details in previous railroad repair shop articles. Hence this article is confined to little more than a listing of the operations in their sequence, for comparative purposes, with illustrations of a few of them and a more extended description of one important fixture.

As the first operation on the side-rod forging, the four sides are slabbed on a 48-in. miller with an inserted-tooth mill as shown in Fig. 1. The layout man then marks the locations of holes and radii, after which a 2½-in. tool-clearance hole is drilled in each end.

Milling the ends on a vertical machine, with a spiral mill, illustrated in Fig. 2, is the fourth operation. It is followed by the operation of boring the ends on a rod-boring machine, as shown in Fig. 3, or trepanning the holes on a vertical miller, with a 3-cutter trepanning tool. The choice of method and machine depends upon the other work available for the two machines and the operator. The remaining operations (for articulated rods) are:

(6) Drill hole in fork end on a 6-ft. radial.

(7) Slot fork ends on a cold-saw.



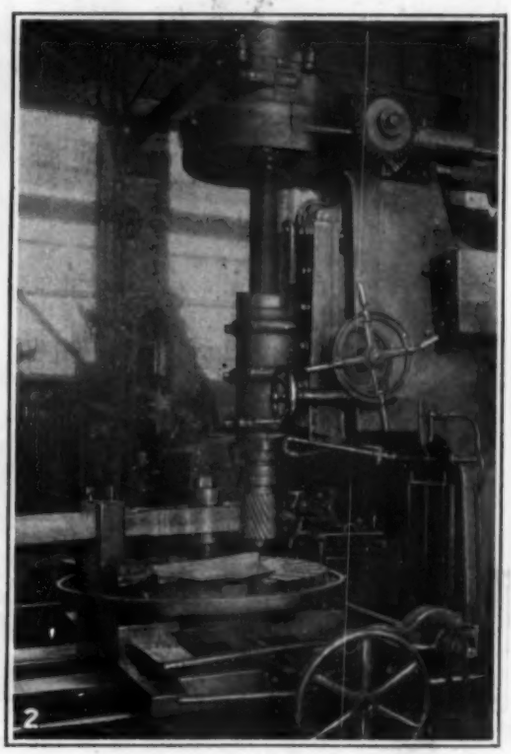


Fig. 1—Slabbing sides of side rods. Fig. 2—Milling the ends

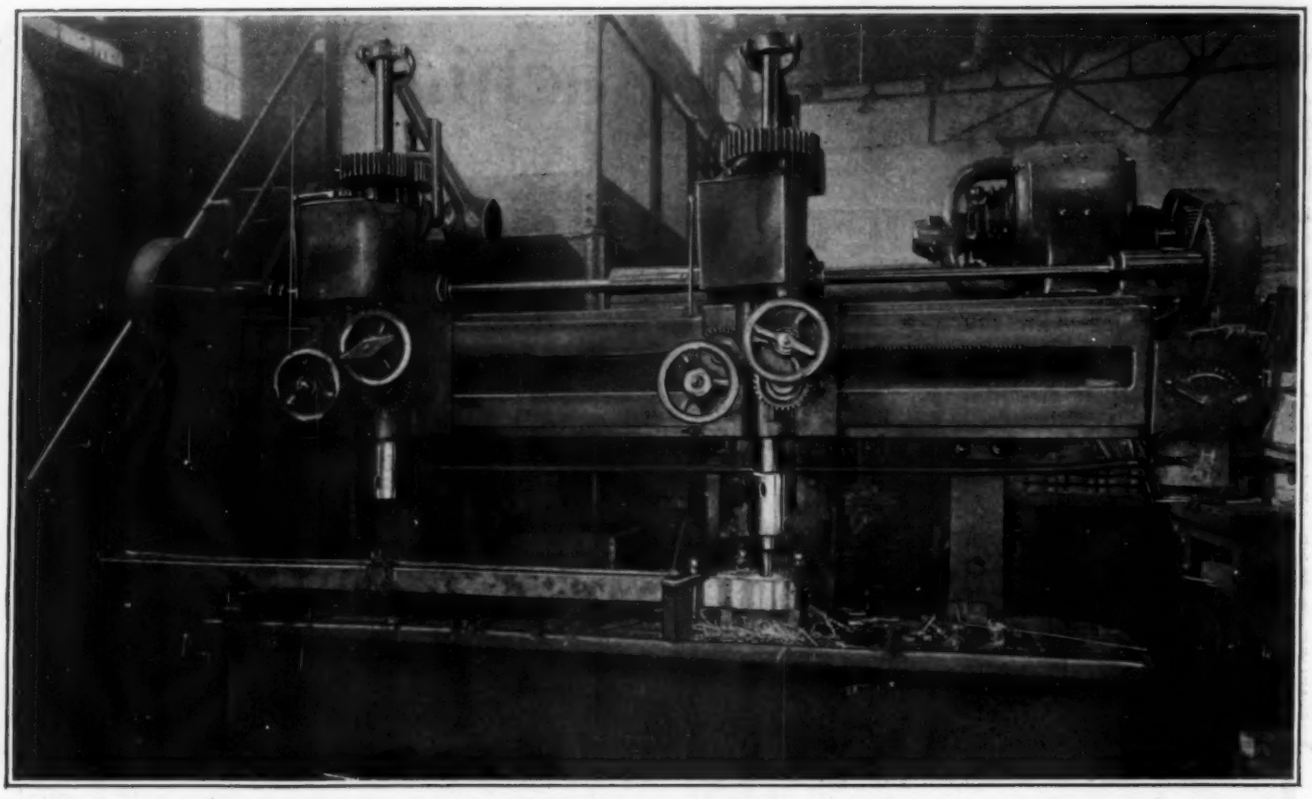


Fig. 3—Boring the ends

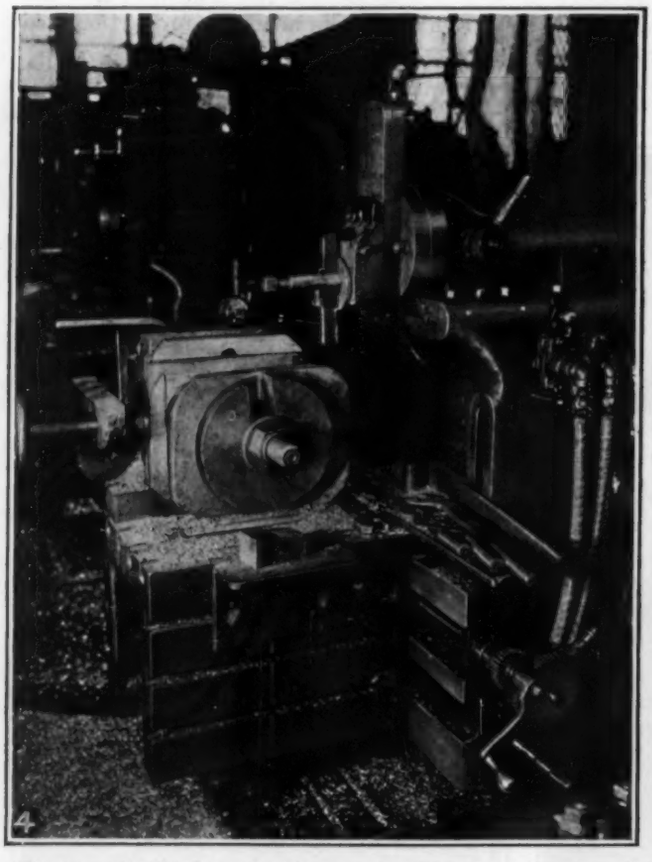
(8) Slot inside of fork (finish operation after sawing).

(9) Finish-bore and ream on the rod-boring machine shown in Fig. 3, to suit knuckle pin.

(10) Press in bushings.

(11) Drill grease-plug and fastening-stud holes.

(12) Chip for grease grooves and plugs, fit knuckle pins, apply fastening bolt, apply grease cup, and tram.



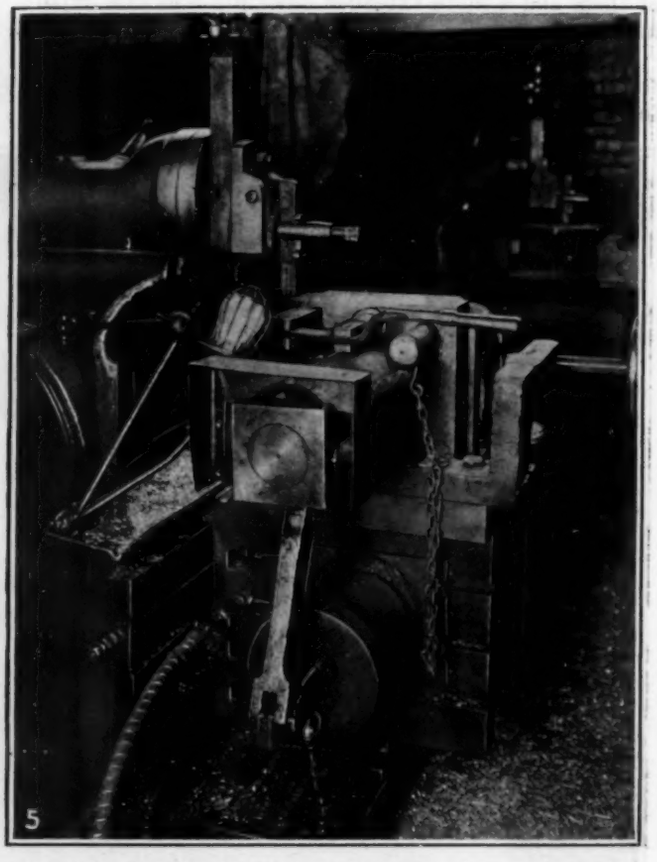


Fig. 4—Machining the brasses to fit the ends of main rods. Fig. 5—Another view of the machine shown in Fig. 4. Note the air-operated fixture

(13) Bore bushings to suit crankpin (on rod-boring machine).

Main Rods

Many of the main-rod operations are practically the same as for the side rod:

(1) Slab-mill four sides as in Fig. 1.
(2) Layout holes and radii.
(3) Drill clearance hole for slotting operation.
(4) Mill radius on one end and square on other end, as in Fig. 2.
(5) Slot for brass and wedge and wedge block.
(6) Drill clearance hole for shaper tool.
(7) Machine wedge-block clearance on shaper.
(8) Fit main-rod strap.
(9) Drill and ream strap-bolt holes.
(10) Fit bolts to drive (size of bolts 1⅞ to 1⅞ in.).
(11) Fit brasses on both ends.
(12) Bore and face brasses (36-in. boring mill).

In machining the brasses to fit the ends of the rod, the air-operated fixture shown in Figs. 4 and 5 is used. It is attached to a 24-in. shaper. The brass is mounted on a mandrel which has a 4-spline sleeve that fits the bore of the brass, the portions between the splines acting as bearing-relief. It is drawn against the index plate by a large nut. An index lever and locating pin are provided to position the brass for machining the three straight sides and an auxiliary pin is used for location when the taper or wedge side is to be machined. A stop screw actuated by a hand wheel, is run up against the brass to act as a resistant to the pressure of the tool. The function of the air clamp is to hold the index plate, against which the brass is held, tight against a rigid member of the fixture. The pressure is released during indexing.

The same kind of fixture is used in machining the strap-fit on the brasses. Instead of the clapper and single tool, a special device carrying two tools mounted on a special clapper, is used.

With these fixtures, the set-up time is very short. Machining time, also, is very much less than that required for the operation as usually done, on account of the rapid indexing and the rigidity of the holding device. On the whole the arrangement is worthy of being copied by many shops.

Tests of Ball Bearings for Rotating-Beam Fatigue Machines

By L. B. Tuckerman and C. S. Aitchison

MISALIGNED bearings introduce bending moments in rotating machine parts which sometimes interfere with the proper functioning of the machine. In such cases the designer has the problem of deciding whether it is better to provide for more accurate alignment or to remove the difficulties by self-aligning devices such as trunnions, gimbals, or self-aligning bearings.

The best solution depends in large measure upon the degree to which it is practical to remove the disturbing bending moments by various devices. This problem recently arose in the design of a rotating beam fatigue machine. The results of the investigation made to determine the magnitude of any adventitious moments introduced by the bearings, may be of interest to others with similar problems.

Sondericker Rotating-Beam Fatigue Machine

In the Sondericker, or symmetrically-loaded, rotating-beam type of fatigue machine, the specimen is supported as a simple beam by two bearings fixed on the base of the machine. The load is applied through two other bearings symmetrically placed in the free span.

The stress is computed by the simple beam formula. This formula gives correct results only where the loads on the beam and the reactions of the supports constitute the only external forces which produce a bending stress in the beam. However, because these external forces are not applied directly to the specimen, but on account of the rotation of the specimen, are necessarily applied through bearings, it was thought possible that some of the discrepancies noted in the results obtained from different types of rotating-beam machines might be due to adventitious moments which had been introduced by the bearings. Tests were therefore made to determine if these moments did exist and, if so, to what extent.

Two types of ball bearings were used, the single-row type mounted with trunnions and the self-aligning type with a double row of balls. Both types are in current use on the Sondericker type of fatigue-testing machine. Fig. 1 illustrates the bearing testing device, with steadying cords, as used for the self-aligning type of bearing. Fig. 2 shows the device used to test the single-row type with trunnions.

The test apparatus was arranged as follows: Three bearings of a certain type were mounted on a round rod or shaft *R*, approximately an equal distance apart. The apparatus, as a whole, was hung by the outer race of the middle bearing to a suitable support, either

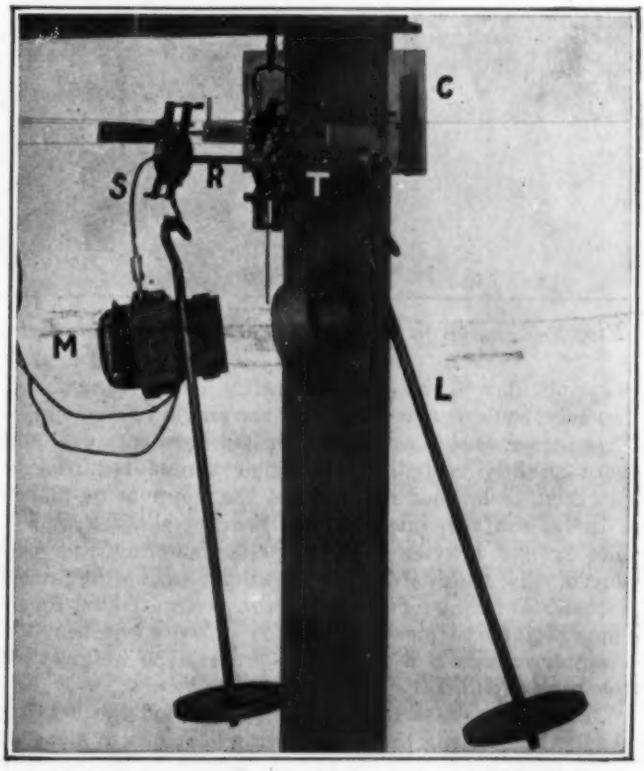


Fig. 1—Testing arrangement for double-row self-aligning bearings

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directly, in the case of the self-aligning type, or through trunnions, in the case of the single-row ball bearing. In like manner weights were suspended on rods hung on the outer races of the two end bearings, and the loads *L* were adjusted until the bearing shaft was practically horizontal.

The bearing shaft was rotated at about 2,000 r.p.m. by a ⅛-hp. motor *M*, the power being transmitted to the bearing shaft by a flexible shaft *S*. The motor was mounted directly on the apparatus so that the balance of the bearing shaft was not disturbed. This was done, in each case, by fastening the motor directly to the rod supporting one of the weight pans.

In the case of the apparatus used to test the self-aligning bearings the motor shaft was mounted nearly

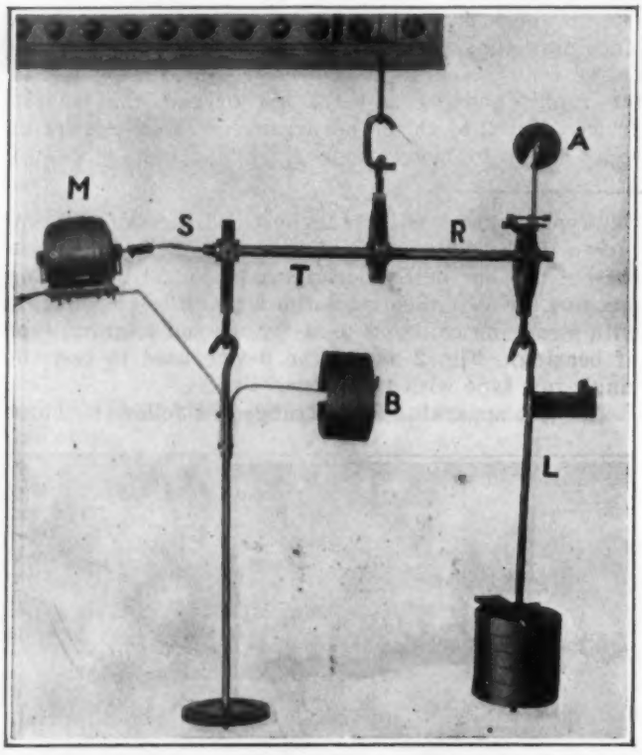

Fig. 2—Single-row bearings in trunnions under test

perpendicular to the bearing shaft. This arrangement, however, could not be used with the single row bearings. These were used bearings which had been scrapped and were slightly rusted. The higher torque required to run them under load necessitated the motor being placed with its shaft in line with the bearing shaft *R*, and a shorter and heavier flexible spring coupling was employed. The rigidity of this short flexible coupling caused a small stabilizing moment which was compensated for by small weights *A* placed above the opposite end bearing. Counterweights *B* were used to prevent the weight rods touching each other.

Mirrors and scales *C* were placed behind the bearing shaft when testing the self-aligning bearings to measure more readily any change in the position of the bearing shaft.

To create the condition of side thrust in the bearings, as found in some fatigue machines, tension springs *T* were used to pull the end bearings toward the middle bearing. Springs exerting a pull of 4½ and 10 lb. were used successively, first on one outer bearing and then on the other.

The method of test was to balance the apparatus at different loads, while running, either with or without side thrust springs and then to apply sufficient weight, first on one side and then on the other, to just throw the bearing shaft out of balance.

The double-row self-aligning bearings showed the presence of adventitious moments as great as 4 per cent of the moments due to the load. The moment average varied 1 per cent with the change of side thrust from one side to the other. This difference was independent of the side thrust (4½ or 10 lb.), indicating a definite play in the bearings. Although they were sufficiently worn to require a much higher driving torque, the single row bearings with trunnions, under all conditions of test, showed no moment difference as great as ½ per cent of the moment due to the load.

For rotating beam fatigue machines the single-row bearing with trunnions is therefore preferable to the double-row self-aligning bearing.

Famous Machinists of History

By H. H. Manchester

Nathaniel Greene (1742-1786)

Nathaniel Greene was born in 1742, at Potowomut, R. I., where his Quaker father had not only a farm, but a forge. In the interims between working at the forge, Greene acquired a large fund of general information, though he had but little regular schooling.

In 1770 he moved to Coventry, R. I., to take charge of a forge which had been built by his father and uncles.

The same year he was elected to the Rhode Island legislature. After joining the militia in 1774, he took up the study of war, and served on a committee to revise the militia, for which he was expelled from the Society of Friends.

In 1775 he was appointed Brigadier General, and the next year was one of the four new Major Generals.

After the battle of Long Island he was placed in command of Fort Lee and Fort Washington, but both were captured by the British.

Greene commanded one of the two columns at the Battle of Trenton, but at Germantown his command, which had further to travel than Sullivan's failed to arrive until after the critical period of the battle had passed.

There were such difficulties about supplies at Valley Forge that Greene was made Quartermaster General in March, 1778, and held the post for two years.

In October he succeeded Gates, who had been badly defeated, as Commander in Chief of the Southern Army. Greene divided up his forces and brought about a series of small battles, of which many were successful. The strategic result, however, was to force the British to withdraw to the coast in order to be in touch with the fleet.

Greene penned up Stuart in Charleston for the rest of the war, while Lord Cornwallis retreated to Yorktown which was eventually captured by Washington.

South Carolina and Georgia voted Greene large grants of land and money. The South Carolina estate he sold to pay the expenses of his troops. He died on the Georgia estate, fourteen miles above Savannah, in 1786.

Duralumin

Its Composition and Treatment

By S. H. Phillips

Extreme care necessary in alloying—Importance of accurate temperature control—Methods of working and machining—Physical properties—Resistance to corrosion governed by heat-treatment

THE uses of duralumin for all types of aircraft are generally known and need not be here emphasized. It is possible that Wilm, the eminent German scientist, originally investigated its possibilities mainly for the purpose of the development of the rigid airship. Whether this alloy will stay with us in the future as the primary metal used in aircraft construction remains to be seen, but we do know that its future is assured for a large variety of purposes in the commercial field.

For the benefit of the reader who perhaps is not entirely familiar with the early treatment of this alloy, the following reference to the pre-ingot stage should be of interest. Do not be optimistic enough to imagine that, after digesting these notes, you can go direct to your foundry and make duralumin. You will probably find that you have to go through the school of experience before you can satisfactorily produce this alloy. The greatest care is necessary in the foundry, particularly in the heating. Some very careful alloying has to be done to bring the melting point down for the final process, nearer to the melting point of the finished alloy and, unless great attention is paid to this, failure is certain.

As in first-grade steels, temperatures must be carefully watched and checked by the use of accurate pyrometers. In fact, the secret of good duralumin lies entirely with the accurate temperature used in alloying and in heat-treatments.

The composition of the finished alloy can be stated as follows:

Aluminum	Difference
Copper	3.5—4.0 per cent
Manganese	0.5—0.75 per cent
Magnesium	0.5—1.00 per cent
Silicon	Under 0.60 per cent
Iron	Under 0.60 per cent

The last two ingredients are generally impurities.

The form in which the raw material is used is important and can be stated as follows:

Ingot aluminum over 99 per cent purity

Copper aluminum alloy	50 per cent copper 50 per cent aluminum
Aluminum Magnesium	Aluminum 90 per cent Magnesium 10 per cent
Aluminum Manganese	Aluminum 90 per cent Manganese 10 per cent

Ingots or billets are cast mostly 44 lb. in weight and of square section, about 4 to 5 in. and about 2 ft. long. These are standard billets. Larger ones are cast as necessary.

The order in which the various constituents are added is as follows:

Ingot Aluminum
Copper Aluminum
Aluminum Manganese

The above are melted and the aluminum magnesium alloy is added when the other melted ingredients are at a temperature of 800 deg. C. They should be cast at a minimum temperature 690 deg. C. or a maximum temperature 710 deg. Centigrade.

The aluminum manganese and aluminum magnesium

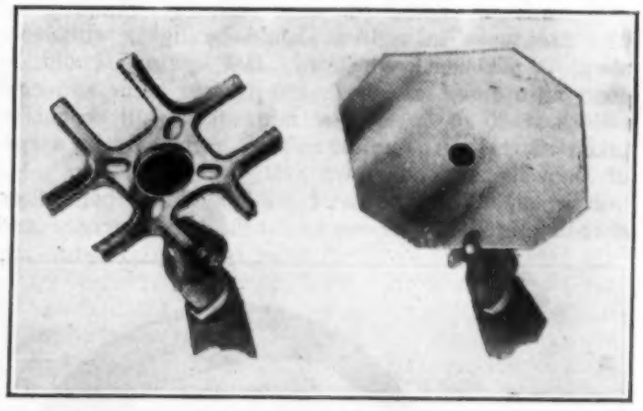

Fig. 1—Stamping requiring several operations

are usually added in the form of 1-in. round rods, approximately 12 in. long. They are placed vertically in the crucible containing the aluminum, when at the desired temperature. The furnace can be heated by either gas or coke, whichever offers the desired convenience. The preheating furnace, if used, must be easily controlled and be uniform in heating.

The ingots for sheets are generally made in thickness of 2, 1½ and 1-in. and are chill-cast. The molds are cast iron, and the insides should be slightly corrugated. China clay is recommended as a wash inside the surface of the mold. Before pouring the chill should be taken off the mold and the temperature controlled between 60 and 150 deg. C. The cooling of the mold before, during and after pouring should be governed largely by experience. If the molten metal is correctly fed there should only be a 5 per cent head. This again, however, will be determined by the skill of the caster.

Ingots can be rolled directly as cast. Preheating will probably not be necessary and is not essential. The preheating furnace, if used, must be easily controlled and be uniform in heating. The temperature of hot rolling should be between 480 and 500 deg. C.

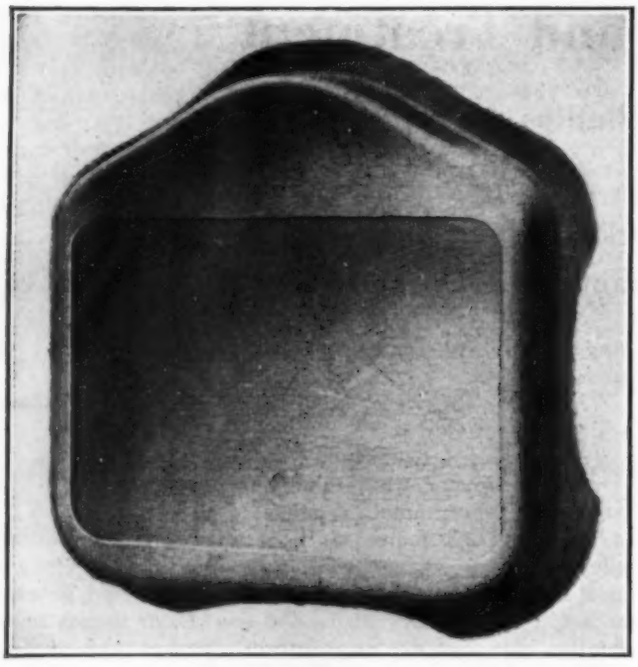

Fig. 2—Radiator casing for an automobile

The first pass in rolling should be light, with only about 5 per cent reduction. Hot rolling should be done at a speed of about 180 ft. per min. and cold rolling at 90 to 120 ft. per min. The chill should be taken off the rolls for hot rolling, preferably by a row of bunsen burners.

It is usual in the case of 1-in. ingots, to hot roll to a reduction of 5 per cent, put back in furnace and

Fig. 3—Automobile fender

reduce in two passes to ¾ in. Reheat and soak thirty minutes and hot roll to about 0.10 in. Ordinary sheets over 0.08 in. thick can be reduced from 0.05 to 0.07 in. in three passes before annealing. When under 0.08 in., the reduction per anneal varies from 0.06 to 0.20 in., being largely governed by the size of the sheet and the composition of the alloy. The condition of the product after rolling should show only slight cracking at the edges. The intermediate annealings are done at 480 deg. C. (maximum) for one-half hour, cooling off in water. Heating should be done in a bath consisting of a solution of potassium and sodium nitrate heated uniformly. The product should be quenched immediately after leaving the bath.

Remelting should be done with care, kneading the metal with an iron rod when in a plastic state. The temperature should be raised to 710 deg. C., the metal thoroughly stirred and 1 oz. of zinc chloride added per 50 lb. of remelted scrap. It should be skimmed, allowed to stand one minute, re-skimmed and cast. With this treatment the alloy made from scrap duralumin will be equal to the original.

The variety of sheet stampings that can be manufactured from duralumin are numerous. The dies used are similar in every respect to those necessary to produce stampings in other metals.

Working, such as the material receives in the action of pressing, ages duralumin rapidly. In other words, hardening takes place practically after each operation, necessitating intermediate annealings before the finished stamping is produced. Final heat-treatment is carried out in either a muffle furnace or a nitrate of sodium bath at a temperature of 420 deg. to 480 deg. C. The period of aging for duralumin, if left standing, requires from three to four days. The material should have then developed its full required strength.

An interesting feature regarding the production of sheet duralumin lies in the method of straightening. Many sheets are buckled as they come from the rolls. Rolled sections of all shapes are invariably twisted when taken from the rolls. In order to take the buckles out of the sheets and straighten sections after rolling, they are subjected to a pull in a hydraulic stretching machine immediately after the material has received its final heat-treatment. Stretching raises the tensile strength of material, but slightly lowers the elongation.

Sheet duralumin can be manufactured of various tensile strengths and elongations. A few of the grades picked at random are as follows:

	Sample 1	Sample 2	Sample 3
Maximum stress lb. per inch	75,000	56,000	84,225
Elongation	16 per cent	18 per cent	9.5 per cent
Percentage in 4 in	.....	17 per cent	10.0 per cent

Sample 2 is similar to sample 1 in tenacity, but is superior in its shock resisting properties. Its distinct superiority over sample 1, however, is in the ease in which it can be forged or rolled. Sample 3, while possessing considerable ductility, is inferior to sample 1 in this respect. There is no difficulty in increasing the elongation to 17 per cent, although the tenacity will be reduced by three or four tons per sq. in. Each of these sample sheets was made from a chill-cast ingot 0.50 in. thick, hot rolled to 0.10 in. and cold rolled from 0.10 to 0.04 inch.

Sample No. 1 will burn if heated above 490 deg. C.
Sample No. 2 will burn if heated above 500 deg. C.
Sample No. 3 will burn if heated above 480 deg. C.

An idea as to the relative cost of a few of the most important stampings used in the manufacture of automobile parts is given in Table I. This should be a useful guide for other types of stampings either more or less complicated.

Table I—Approximate Cost of a Few Selected Stampings Made from Duralumin

Item	Cost of Material	Approximate Cost of Die	Cost per Thousand
Stamping Fig. 1	$1.00 ea.	$400	$1,500
Radiator casing Fig. 2	3.00 ea.	1,500	3,300
Fender Fig. 3	2.50 ea.	2,000	5,000
Tire rim Fig. 4	4.00 ea.	250	5,000

All types of rolled sections are possible and can be manufactured up to lengths of from 36 to 40 ft. Beyond this they become difficult to handle.

Duralumin can be machined at the same speed as brass. Unlike aluminum alloys it does not seize or drag the tool. Tempered, or in the hard-rolled state, duralumin is in the best condition for machining.

Kerosene is a good tool lubricant in machining. The material threads well in the hardened state, but threaded work is preferably used in conjunction with a different metal, on account of the tendency for duralumin to seize or bind when in rubbing contact with itself.

The coefficient of friction of duralumin in contact with itself and other metals can be stated as:

Duralumin to Duralumin	0.33
Duralumin to Steel	0.25
Duralumin to Brass	0.27

In Table II are given comparative tests of duralumin and babbitt when used for bearings.

Table II—Comparative Tests of Bearing Metals

A-5T Baush Casting Metal

Load in Pounds per Sq.In.	Revolutions per Minute	Total Number of Revolutions	Final Temperature Cent.	Final Temperature Fahr.	Rise in Temperature Cent.	Rise in Temperature Fahr.	Friction in Pounds	Loss of Weight in Grams	Remarks
100	626	37,500	48	118	23	73	21.15	.....	Impossible to obtain loss of weight
200	628	37,680	60	140	28	82	42.30	.....	
300	614	36,840	49	120	28	82	63.45	.....	
400	618	37,080	54	129	27	81	84.60	.....	
				Bt Duralumin					
100	632	37,920	39	102	18	64	21.15	21.15	Bearing roughed and ran warm ten min.
200	625	37,500	71	160	70	158	42.30	.....	
300	629	37,740	54	129	32	90	63.45	.....	
400	623	37,380	62	144	39	102	84.60	.....	
				Genuine Babbitt					
100	694	12,230	89	192	53	95	22	0.023	Belt slipping. Bearing seized, smoking
200	706	16,510	102	216	58	104	29	0.021	
300	686	15,150	125	257	100	180	38	0.013	
400	603	6,600	139	282	94	169	79	0.054	

In Table II are given comparative tests of duralumin and babbitt when used for bearings.

Rolled or extruded bars, plain and die forgings have values under test as follows:

	Extruded Bars	Hammered Bars	Forgings and Stampings
Ultimate tensile strength....	56,000	38,080	51,500
Yield point in tension.....	16 per cent	10 per cent	15 per cent
Elongation on 2 in.....	15 per cent	15 per cent	15 per cent
Reduction of area.....	20 per cent	.....	.....

Note: Bars up to 2½ in. are extruded—above 2½ in. hammered.

For forging, duralumin should be heated in a muffle furnace to a temperature between 380 and 420 deg. C. Forging should be done immediately after the metal leaves the muffle.

No definite rule can be given as to when reheating is required, but when the material is worked too cold, it gives a decided ring and probably cracks. After forging the same final treatment in the salt bath previously described is required in order to obtain the full normal strength.

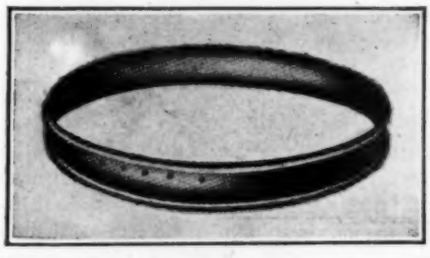

Fig. 4—Wheel rim

Probably the largest field for forged-duralumin parts is in connecting rods for automotive engines, and in Fig. 5 an excellent example of such a forging is shown.

Very little information is available as to the behavior of duralumin under fatigue, but it is understood that it is subject to a reduction of approximately 20 per cent of its ultimate tensile strength after 63,000,000 cycles of stress.

Hammered bar-stock of 38,000-lb. tensile strength can be obtained reasonably cheap and if heat-treated after forging, can be brought up to normal strength of 56,000 lb. per square inch.

Duralumin should not be placed in contact with an open flame as the material will be damaged. This method of heating has been employed but it is decidedly bad practice.

Drop forgings are cheaply produced and in the majority of cases no intermediate annealings are required.

Duralumin sand-castings are distinctly inferior to castings of high-grade aluminum alloys. The properties of sand-cast duralumin can be stated as follows:

	Tensile Strength lb. per sq.in.
Sand cast	15,600
Sand cast and quenched	19,900
Chill cast	14,200
Chill cast and quenched	21,300

The elongation of duralumin sand-castings is approximately zero. The possibility of die-casting duralumin is worth while investigating, as it can be worked in the plastic state.

Sheet duralumin is being used for aircraft work, for automobile bodies, disk wheels and rims. Duralumin rods and wire are being used for screw machine products and rivets. Duralumin tubing has now reached a production basis but is at present rather costly. Its largest application is in aircraft work.

Ordinary spar or spirit varnishes having suitable elastic qualities, make good protective coatings for duralumin. The varnish may be tinted in order that it may be readily seen. Enamel or paint may be applied over the varnish, though paints containing zinc or lead pigments are not recommended. In connection with the possible production of duralumin body-parts of automobiles, the protective coating is of some importance. The hard baked enamelling of the surface is possible. The best enamel which has so far been found is made of hard foccil copal in linseed oil, in the proportion of about 12 lb. of copal to 1 gal. of oil. The enamel can be colored by the addition of about 13 oz. of carbon black per gal. of oil. Two applications of enamel each baked for four hours at 260 deg. C. give an efficient coating.

Duralumin is not acted upon by sea water or affected by atmospheric influences and if properly varnished, it will not corrode under any of the ordinary conditions of service.

Nearly every case of corrosion so far experienced in actual practice, has been traced to incorrect heat-treatment or to cold working after heat-treatment. The rate of cooling in heat-treating has a strong influence on the resistance to corrosion, the pieces most slowly cooled being the most readily attacked.

The following information regarding corrosion of duralumin, as compared with other metals is quoted from H. Kuerr's paper on Duralumin, printed in the *Transactions of the American Society for Steel Treating:*

"Profiles of duralumin, copper, iron, aluminum alloys, pure aluminum and electron metal were exposed to the action of sea air on a light-ship in the North Sea for three months. These sections were also riveted and screwed together. Duralumin resisted these conditions better than any of the other materials and

showed practically no oxidation. Tests made at the ship-building docks of Vickers, England, by hanging four pieces one foot square so that they were immersed at high tide, showed a loss in weight after six months of approximately 0.001 gram per square centimeter. Specimens exposed in the open air alongside a dock for eight years were only slightly discolored and showed the same strength as obtained a week after heat treatment."

Metals electro-negative to duralumin are copper, brass, bronze, iron, steel, etc., and should not be connected or joined to duralumin where subjected to moisture. Steel rusts rapidly in contact with duralumin. In all cases where steel is in contact with duralumin, the steel should be galvanized.

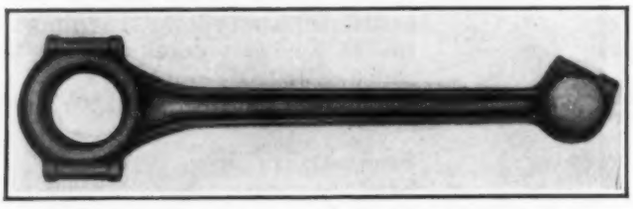

Fig. 5—Connecting-rod forging

The ability of duralumin to retain its polish after buffing is remarkable. The writer has in his possession specimens four years old, which still retain practically the same amount of polish as originally given them. Polish undoubtedly protects the metal to a marked degree from corrosion. The brilliant luster duralumin obtains when polished, is silver-like in appearance and in consequence it makes an ideal material for ornamental purposes.

To the reader who wishes to obtain more technical information on duralumin, he is recommended to read H. Kuerr's article as previously mentioned, or J. A. Binne's article on page 221, Vol. 58, of the *American Machinist*.

House-Cleaning in Slack Times

By A. L. De Leeuw

THE attitude of different concerns toward slack times is as varied as the attitude of people in general toward life. Some droop immediately and lose all courage as if the end of things had been reached. The factory is closed, men are dismissed, and the accumulated stock, if there is any, is sold as if the concern were in a state of liquidation. When times become better, gradually of course, there is hesitation because of fear that the improvement is only temporary. Such concerns make a little money when times are so good that they cannot help making it and they lose it again as soon as clouds appear on the horizon. They are the weak brothers. They will be the down-and-outs when they are somewhat older.

Others are of the opposite temperament. They feel that the storm is only a shower. They keep right on manufacturing and keep their organizations intact, not realizing perhaps, that not all the people employed are necessarily parts of the organization. They happen to be there but they may not belong. Such concerns borrow money and perhaps rent buildings to fill with manufactured but unsold stock. They survive and bloom richly if the storm is a shower but if the opposite is the case they are likely to be struck by lightning, washed away or swept off the face of the earth. They are the speculative kind whom we admire and to whom we devote headlines in the papers *if* they are successful.

Then again, there are still others. They reason that an occasional storm is perhaps not such a bad thing. It clears the air, destroys fair weather competitors and gives them a chance to get rid of some employees who are producing merely a dollar's worth or somewhat less for every dollar received, but who never belonged to the organization. Such concerns slow down but only so far as necessary. They may borrow, but never beyond a safe limit. They survive and grow. They may not be spectacular but they are not apt to explode. They are like well-rooted, sound trees. They may lose a few minor branches during the storm, but the loss will not be perceptible the following spring.

The Time to Replace

And again there is a difference between various concerns of the class mentioned last. Some seem to think that the only profitable way to weather the storm is to keep on manufacturing at a safe rate, curtailing all unnecessary expense and building-up stock for the good times to come. This procedure seems so reasonable that we almost forget that there are other and perhaps better ways to accomplish the same result. To build-up stock is right. To weed out dead wood also is right, particularly in slack times. Cutting out all unnecessary expense is, of course, right, bad times or good. One thing, however, is often forgotten, which is that bad times are particularly good times for house-cleaning, for renovating, for revising of methods, for re-arranging of machinery and men and above all for purchasing and installing new kinds of machinery, something that requires the undivided attention of foremen and engineering department in order to give good results quickly.

The money spent, possibly borrowed money, for the up-building of stock is spent with the idea of getting returns when good times have once more arrived. This is the only incentive and the real question for the management of the company is to determine in what manner he can get the best returns. If he keeps the organization intact while building the company's product, he does so only because he expects to make a profit later on. But if a larger profit could be made by doing the things which cannot possibly be done well while everybody is concerned about getting the product out as rapidly as possible, then why shouldn't he do these things?

Too Busy in Good Times

To overhaul machinery while everybody is rushing to fill orders is a difficult thing. It seems to be almost impossible, judging from the appearance of the equipment in most shops during rush times. To install new machinery also seems to be a difficult thing. New methods and new machinery require the attention of the best talent in the shop and such attention cannot be given in rush times. Doesn't it seem reasonable then that these things should be done in slack times and that at least part of the money which is ordinarily spent for the building-up of stock would better be spent for rehabilitation of the shop, re-organization of the men and methods and the introduction of new methods and machinery? It is a safe guess that the final profit will be greater.

Automotive Production

A Study of an Unusual Transmission

By John Younger
Associate Editor, *American Machinist*

Adapting a special machine to another job—Operations on the pawls for the Traffic Transmission—Layout of a department for efficiency both in slack and in rush times

A SPECIAL Ingersoll milling machine is used to machine the three faces of the transmission case, Fig. 10. This machine is highly special and is a visual example of the close co-operation that exists between the Chandler engineering and production departments. Faced with the design of a new transmission, embodying overall lengths different from the preceding unit, the engineering department so schemed its work that it was able satisfactorily to work in this special tool, thereby saving a heavy investment. This by the

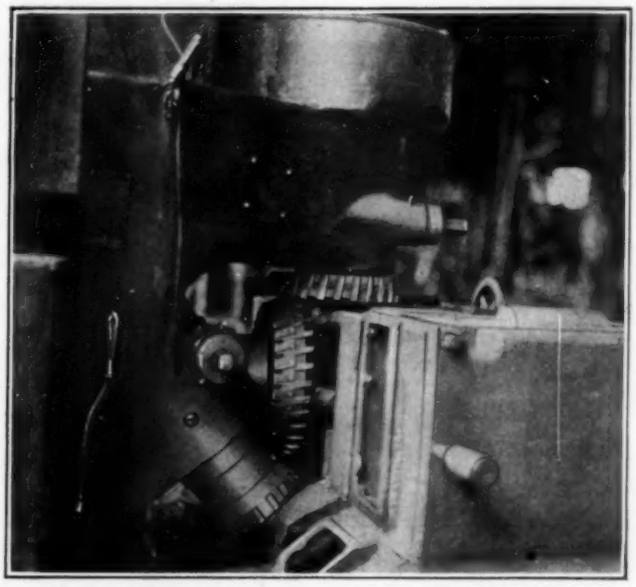

Fig. 10—Special tooling on an Ingersoll milling machine

way is an answer to some of the opponents of the specialized machine, who say that its term of usefulness is ephemeral. There is no reason why it should be if we were able to get always whole-hearted thorough-going co-operation.

There is a right and a left hand short pawl, and a right and left hand long pawl. To all intents and purposes they are alike, so no difference will be made in this article. Fig. 11 shows the pawl, and it will be noted how awkward is its shape and how difficult to hold. There is perhaps one simile that comes up in studying

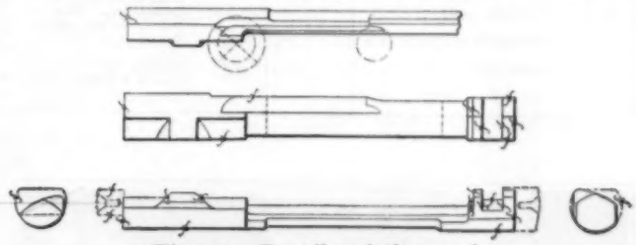

Fig. 11—Details of the pawls

this, and that is its resemblance to a rifle bolt in the intricity of its operations. Exclusive of the annealing and forging operations there are 23 separate individual operations on each pawl. These are tabulated in the routing sheet, Fig. 12, in their proper sequence.

One interesting operation is that of milling the radii and Fig. 13 shows this clearly. An 18-in. Cincinnati miller is used with the cutters straddled, as shown. The pawls are assembled in a rotary fixture and as each completed one comes to its station before the operator, it is removed and an unmachined one put in its place. The fixture is a simple bar with grooves cut into it to accommodate the pawl accurately. The clamps shown in the picture hold it securely in place.

Another interesting operation is No. 14 in which a rotary cam fixture on a Barnes drill press mills the radii on the side of the pawl tooth. Fig. 14 shows this clearly and also illustrates another use for the rotary continuous fixture. One example of a special grinding fixture is shown in Fig. 15, operation No. 12. This fixture is hand-operated, being swung to and fro, carrying the work across the wheel.

The layout for machining the pawls is shown to scale in Fig. 16, the machines being numbered in accordance with the sequence of operations. The small letters refer to the workmen operating each machine. Thus operator *C* operates machines 2, 3 and 4. Operator *F* has machines 7, 8 and 9 to look after. There are only

Concluded from Vol. 61, No. 9, p. 337.

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OPERATION AND ROUTING SHEET

Date 6-3-24 Group No.

Part Name TRANSMISSION SLIDING PAWLS Part No. 30101-2-3-4

Material SAE #3450 Model 35 Req. per car 1 each Sheet No. 1 - 2

OPER. No.	OPERATION	PRICE	HRLY. PROD.	TOOL No.	TOOLS OR EQUIPMENT
1	Grind burrs, twist & rough straighten.		91.5		Bench
2	Center both ends		213		Cadillac Center. Mch. Holding Fixture
3	Turn short shifter end Turn pawl end		48.8		Sunstrand Lathe " "
4	Grind radius on plunger seat		126		Landis Grinder
5	" both ends		43.6		" "
6	Mill location		106		18" Cinn. Mill Gang Fixture
7	Mill radii-pawl side		69.5		18" Cinn. Mill Continuous Mill Fixt.
8	Mill radii - plunger side		69.5		18" Cinn. Mill Continuous Mill Fixt.
9	Straddle mill shifter end		110		18" Cinn. Automatic Gang Fixture
10	Saw pawls to length		69.5		Milwaukee Mill Gang Fixture
11	Grind & file burrs after sawing to length		57.4		Bench
12	Grind radius - plunger side		62.2		Landis Grinder Special Arbor
13	Straddle grind (2) radii-pawl side		107		Landis Universal Grinder Special Arbor
14	Mill reliefs on pawls		90		Barnes Drill Press Rotary Cam Fixture
15	File burrs after milling reliefs		73		Bench
16	Mill plunger seat		42.2		Whitney Hand Mill Double Fixture

OPERATION AND ROUTING SHEET

Date 6-3-24 Group No.

Part Name TRANSMISSION SLIDING PAWLS Part No. 30101-2-3-4

Material SAE #3450 Model 35 Req. per car 1 each Sheet No. 2 - 2

OPER. No.	OPERATION	PRICE	HRLY PROD.	TOOL No.	TOOLS OR EQUIPMENT
17	Hone plunger seat & file burrs		56.4		Bench
17A	Countersore (1) end Note:- 30103-4 only.		114		Silver Drill Press Special Fixture
18	Heat treat				Automobile Machine Co
19	Finish straighten before pawl side grinding, chamfer & grind faces on shifter end.		36.7		Bench Bench Grinder
20	Grind pawl face		60.5		B & S Surface Grinder Gang Fixture
21	Grind radius pawl face		240		Landis Grinder Special Arbor
21A	Grind flat on pawl		266		LeBlond Tool Grinder Holding Fixture
22	Finish straighten and fit to main shaft.		45.2		Bench
23	Cut buff and polish radii plunger seat and O.D.'s.		41		U S Polishing Stand

Fig. 12—Route sheet for pawls

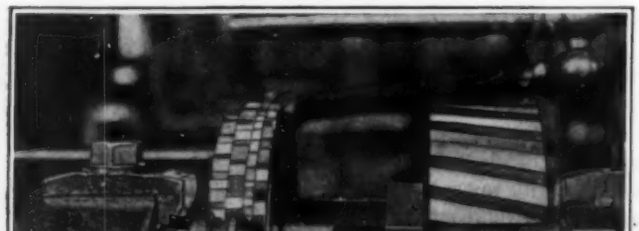


Fig. 13—Milling radii on pawls

15 operators for 21 machines, and this brings up an interesting policy in the Chandler shops. The work is arranged for progressive assembly, but instead of a man having only one operation to do in the line, he is

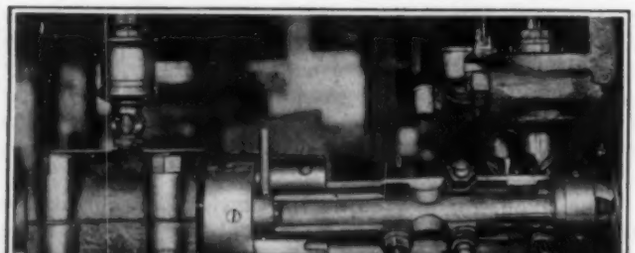


Fig. 14—Rounding pawl detents in a drill press

Fig. 15—Example of special grinding fixture

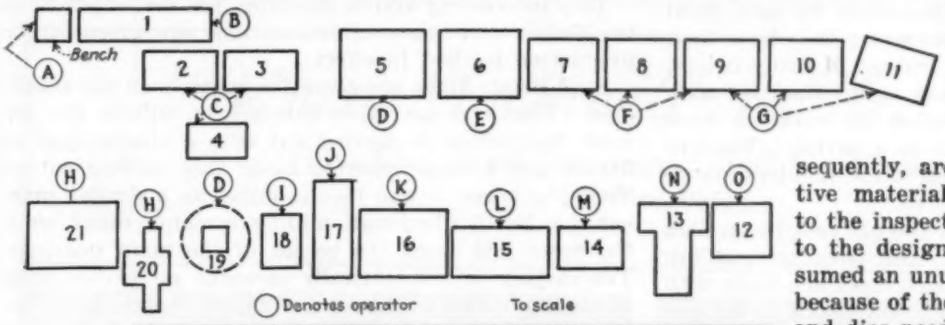
given as many machines as he can possibly work at. This means of course that the men have necessarily to be more versatile in their work and have to have more training time spent on them, but the results expressed in ultimate cost are that the system is economical. One valuable feature is that in times of slack running a few versatile operators can handle a whole department and keep up a quantity of lessened production almost as economically as if the shop were going at maximum capacity. In the extreme form of production line this is almost impossible as the line has either to be going

AUTOMOTIVE PRODUCTION

at its regular speed or it must not be operating at all.

One of the keystone records is that of machine capacity illustrated in Fig. 17. This shows at once that the two machine tools already up to maximum are No. 6 and No. 18. This chart visualizes also the machines that have special attention in order to bring them up to greater efficiency. It is of little use spending money to improve the efficiency of machine No. 19, for example, which has a capacity of 100 pieces in 1.5 hours as long as attention is demanded by machine No. 8, which requires 6 hours for its quota.

In concluding this article thanks should be expressed to Mr. J. R. Hall, Vice-president and Factory Manager, Mr. Eugene Bouton, Supervisor of Time Study and Mr. A. H. Frauenthal, Chief Inspector, for their very wholehearted co-operation in the furnishing of material.



LAYOUT OF TRANSMISSION PAWL DEPARTMENT			
1	Cadillac centering machine	12	18" Cincinnati duplex mill. mach.
2	24" sundstrand lathe	13	Millwaukee plain mill. mach.
3	24" sundstrand lathe	14	Rotary cam milling fixture
4	Porter-Cable lathe	15	Universal Landis grinder
5	6"x18" Landis grinder	16	6"x18" Landis grinder
6	6"x18" Landis grinder	17	Silver upright drill
7	18" Cincinnati manuf. mill. mach.	18	No. 6 Whitney hand mill. mach.
8	18" " " " "	19	Le Blond grinder
9	18" " " " "	20	B. & S. surface grinder
10	18" " " " "	21	6"x18" Landis grinder
11	18" " " " "		

Fig. 16—Machine layout for operations on pawls

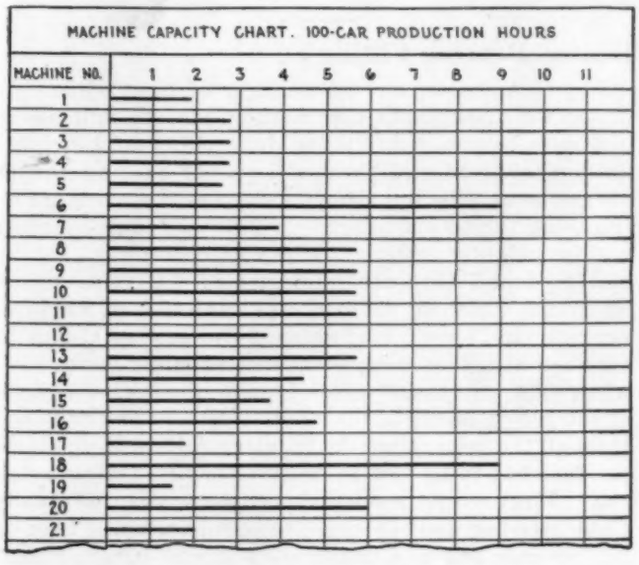


Fig. 17—Record of machine capacity

Abstracts

from other publications

Some Points on the Inspection of Processed Material

C. S. Stark, chief inspector of the Packard Motor Car Co. states that details of inspection vary in different automobile plants. This is because the larger plants have greater quantities of material in process, whereas, quality-car manufacturers, having a much smaller quanity of material in process, require more machine set-ups and, consequently, are likely to produce more defective material. Paying particular attention to the inspection of threads, which, previous to the design of the first Packard-Six, consumed an unusual amount of time and labor, because of the special stands and special taps and dies needed, and with a view to finding a more economical and at the same time more accurate method of inspecting threads, a thread-limits committee was appointed to make an investigation and report its findings, which should prove to be of great value.

For the economical inspection of large quantities of small parts, such as machine screws, the stock to be inspected is spread out on a bench so that the general condition of the material may be visualized. By examining pieces at random, the exact percentage of defective work can't be determined. This percentage varies with the part. If a percentage greater than that considered allowable is found, the lot is subjected to detail inspection. Inspectors have only one function to perform and that is to separate the work before them strictly in accordance with the gages, or to examine for defects visually in accordance with the standards supplied to them.

A. H. Frauenthal, chief inspector of Chandler Motor Car Co., Cleveland, deals with the influence of numerous handlings on inspection cost, stating that transporting and handling the material constitute a large part of the expense of inspection. The cost of transportation has not been considered in this paper, but only the time consumed in picking up and laying down gages and parts. A test made of the time required to scleroscope cam rollers by two different methods, in one of which the hammer was operated by a hand-bulb and in the other by a foot-pedal, showed that the former method requires 7.8 sec. per piece, the latter 6.0 sec., a saving of 30 per cent. Multiple gages that check several different parts simultaneously avoid many of the slighter movements.

When the tolerance is more than plus or minus 0.003 in. the flush type indicator or "flush-button" gage is said to have proved very satisfactory. Their use in the multiple inspection and checking of water-pumps is

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described, as is also a fixture for checking the spiral gear on the camshaft and its mating gear on the oil pump in ordinary camshaft inspection. Doubling up of inspection cuts down the initial gage-cost and makes unnecessary the picking up or the laying down of the camshaft or the oil-pump gear.

C. J. Jones, chief inspector of the Lincoln Motor Co., Detroit, deals with maintaining high-quality production and states that inspection can be maintained only through the co-operation of the engineering and the production departments and is insurance against defective material entering the product. To get men of the right caliber it is sometimes necessary to take them from the production departments where they have been in charge of particular lines. Instead of being a loss, scrapping the parts that are not up to standard puts those concerned on their toes, makes the workmen more efficient, and in the end results in a saving. Vendors who have been unable to work up to the required standards have been shown how to do so.

All parts received are given a 100 per cent inspection, including metallurgical, visual, heat-treating, pickling and Brinell tests. Aluminum crankcases are made with test-bars attached for testing. Every detail in the engine assembling department is watched, from the machining of the component parts to the final test, as is also every operation on the chassis, from the time the frame starts on the line until all the parts have been assembled complete.

All painting materials are furnished to the body builders after having received every known test in the paint test-room.—*The Journal of the S.A.E.*, August, 1924, p. 156.

How Mechanical Handling Builds Ford Profits

This particular issue is entirely given up to the consideration of the River Rouge plant of the Ford organization. It is difficult to appreciate the fact in its full significance that the Ford organization is not merely an automobile manufacturing company, but is an actual reality as a wonderful consolidation of a number of really large companies, all contributing of course to the final truck.

At the River Rouge plant, for example, we find: Coke ovens with all the by-product industries that go with them, a large coal pulverizing plant, complete blast furnace equipment for the making of iron from ore, a large jobbing foundry which is in itself an industry worthy of being separate and apart, immense machine shop where all parts for Ford cars are finished, electric furnace building fully equipped for the manufacture of steel, complete cement plant, a sinter plant for handling flue dust from the blasting furnaces, the tractor assembly building with the necessary machine shops for the complete production of Fordson tractors, a complete woodworking shop for the manufacture of Ford car bodies, a complete glass plant for the manufacture of plate glass, and a sawmill which handles lumber in the form of logs, cuts it, sorts it, kiln dries it, seasons it, on the same plant property. Finally there is a building devoted entirely to the construction and repairing of the steam locomotives used on the D. T. & I. R. R.

A splendid illustration of the plant is given with a summary of equipment used in handling materials, and then follows a series of articles by Mathew W. Potts, well illustrated, dealing with the receiving and distributing of raw material, the handling of materials in the blast furnace, the foundry, the machine shop and other buildings that have been enumerated. For those studying Ford system this article should be read closely.—*Industry Illustrated*, Aug., 1924, p. 13.

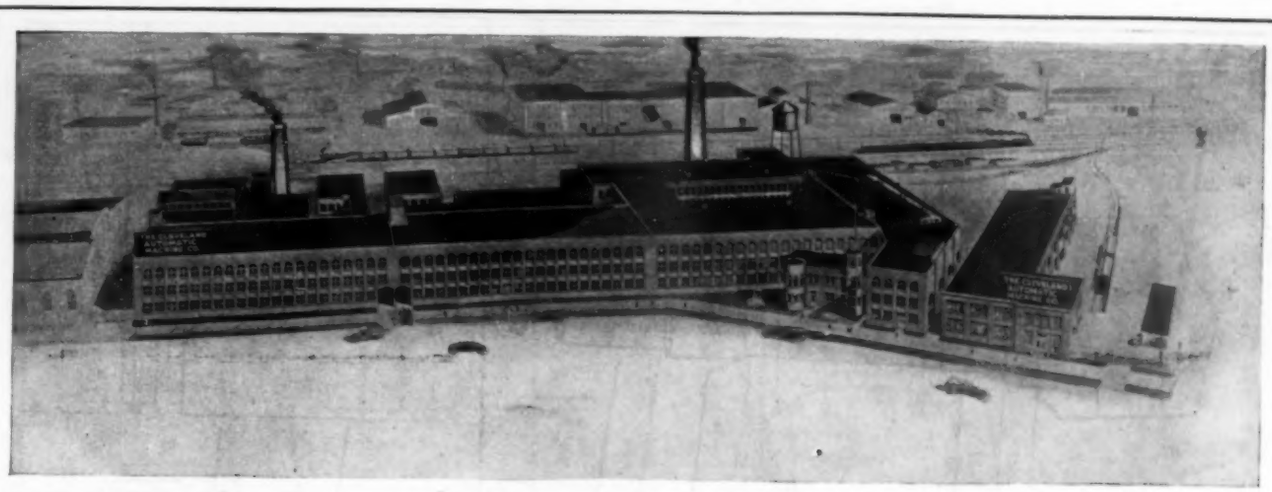
Intensive Production in England

This interesting article describes the manufacture of the Cubitt car. Several illustrations are given of the production method in effect.

Such illustrations are given for example on the crankcase. The first operation consists in milling the top joint face which is carried out with a simple type of fixture and a large inserted blade face milling cutter. Then the lower or pan face is milled in a similar manner. A No. 5 Cincinnati milling machine rough mills the bores and faces the bosses of the main bearings. The casting is fed vertically upwards on to the gang of cutters which are driven at approximately 80 r.p.m. In this way correct and uniform spacing of the end faces of the crankshaft bearings is obtained, while only a light cut is left for the final operation of boring the bearings. In boring the crankcase the fixtures are mounted on ball bearings making them quite free to move into alignment with the machine spindles when the pilot plate is placed in position. This tends to greater accuracy in boring. In machining cylinders the Moline "Holehog" four-spindle vertical boring machines are used for roughing and finishing. The cylinder bores are finished by grinding. Many illustrations are given of these operations and of the plant.—*The Automobile Engineer*, Eng., July, 1924.

Engine Bearing Fitting

Daniel Andrews, service manager of the Continental Motor Corp., suggests that a 12-in. smooth mill file is generally best suited for the draw filing of bearings. Soft metal lined vise jaws and proper backing should always be used before clamping in vise to prevent bushing being forced out of shape. Different engine models require slightly different end-play clearances, but it will be found that the minimum of 0.004 in. and a maximum 0.010 in. will suit the majority of engines. Bearing nuts should be tightened two or three turns to each nut at a time until the final tightening is reached, when each nut should be tightened in rotation a little at a time. Bearing adjustment is usually accomplished through the removal of the required shims. Sometimes the face has to be filed in order to bring it down properly. Many expert mechanics believe that an unusually tight bearing indicates good workmanship. This is not the case and as a matter of fact, it is generally just the opposite. With well scraped or reamed bushings having 85 per cent or better shaft contact, you may have the caps drawn tight and still have enough clearance between the bearing bushings and shaft bearings to permit of a free turning operation.—*Motor Service*, August, 1924, p. 22.

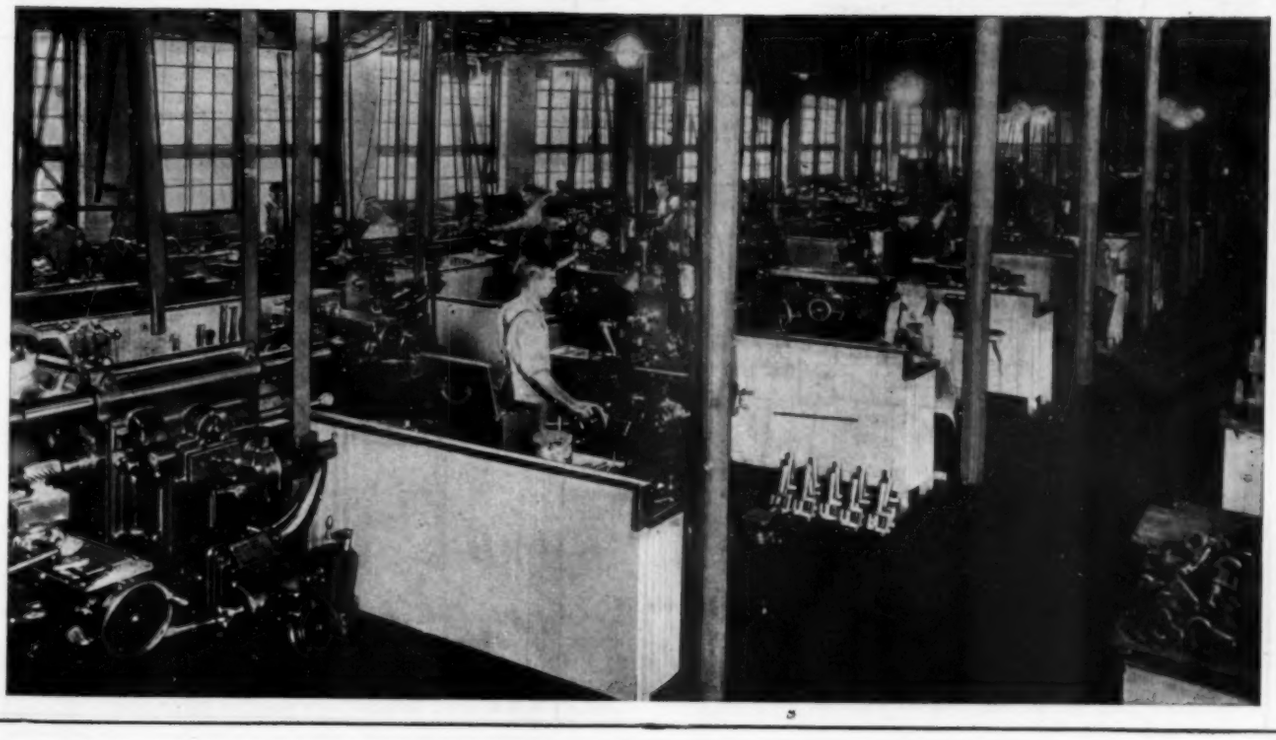


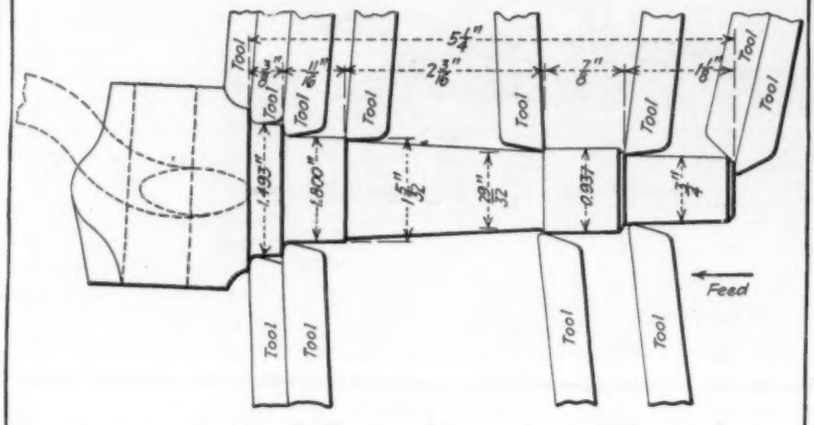
Where Machine Tools Are Made

The Cleveland Automatic Machine Company

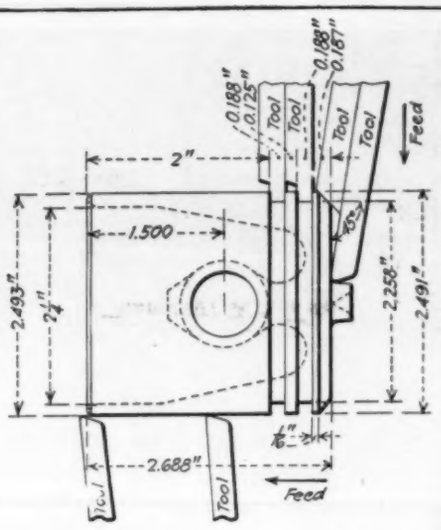
Cleveland, Ohio

Established 1891

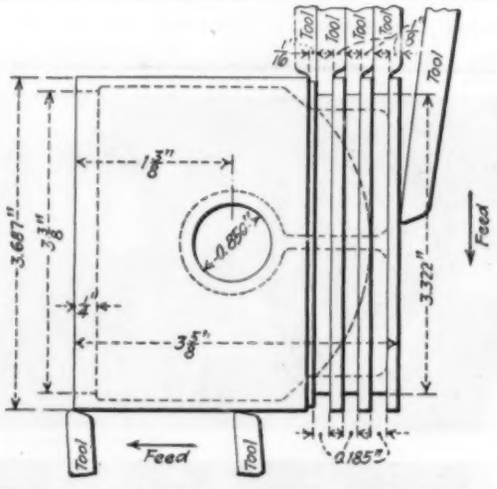




Steering knuckle—S.A.E. 2330. Turn and face stem-end; 4 turning tools, 8 facing tools, 55 ft. per min. Feed 0.014 in. rev. Total time 1 minute.



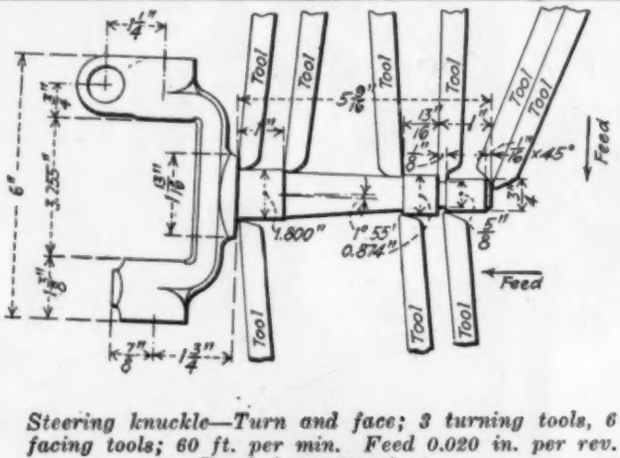
Piston, aluminum—1st operation—Rough turn, groove and face; 2 turning tools, 4 facing tools; 400 ft. per min. Feed, 0.022 in. per rev. 2nd operation—Finish turn, groove and face; 1 turning tool, 4 facing tools; 400 ft. per min. Time 1.28 minutes.



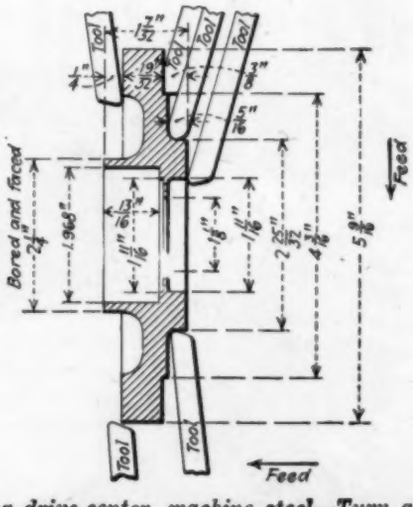
Piston, cast iron—1st operation—Rough turn, groove and face; 2 turning tools, 5 facing tools; 65 ft. per min. Feed 0.028 in. per rev. 2nd operation—Finish turn, groove and face; 1 turning tool, 5 facing tools; 150 ft. per min. Feed 0.020 in. per rev. Total time 2.7 minutes.

What Modern Machine Tools Are Doing

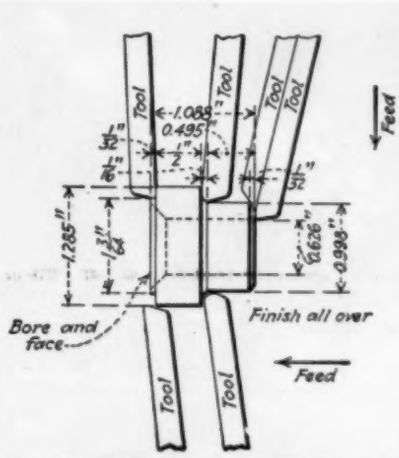
LeBlond Multi-Cut Lathe



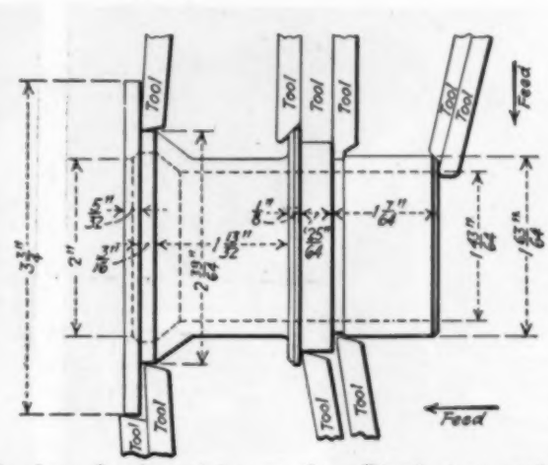
Steering knuckle—Turn and face; 3 turning tools, 6 facing tools; 60 ft. per min. Feed 0.020 in. per rev. Total time 0.55 minute.



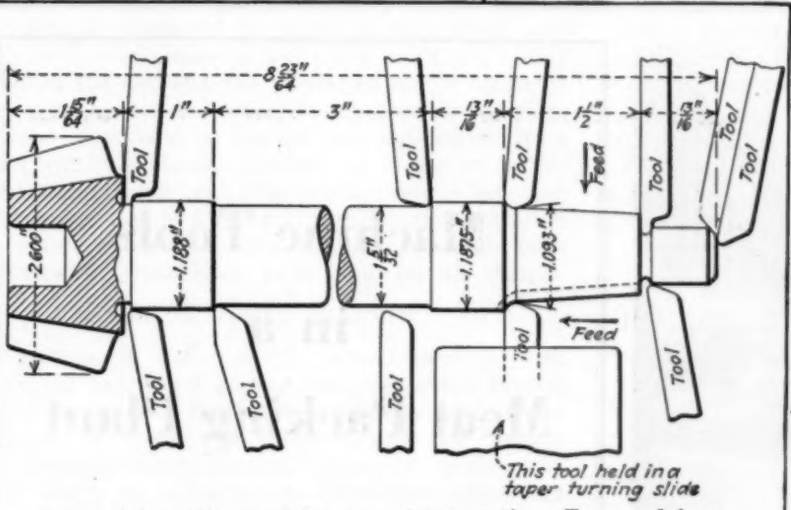
Spring drive-center, machine steel—Turn and face; 2 turning tools, 4 facing tools; 65 ft. per min. Feed 0.020 in. per rev. Time 2 minutes.



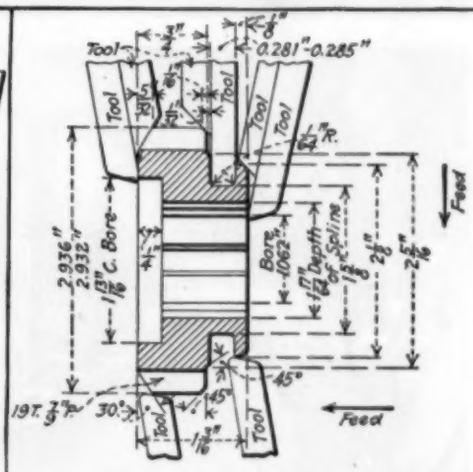
Guide, cold-rolled steel—Finish turn and face; 2 turning tools, 4 facing tools; 65 ft. per min. Feed 0.016 in. per rev. Total time 0.5 minute.



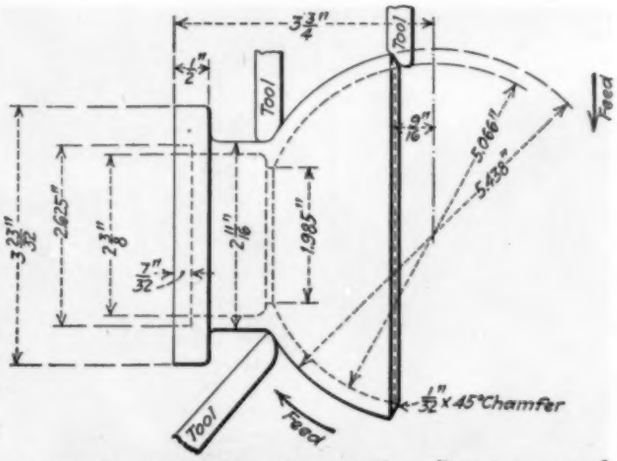
Hub, drop forging—1st operation—Rough turn and face; 4 turning tools, 6 facing tools; 55 ft. per min. Feed 0.022 in. per rev. 2nd operation—Finish turn and face; 4 turning tools, 6 facing tools; 80 ft. per min. Total time 3.75 minutes.



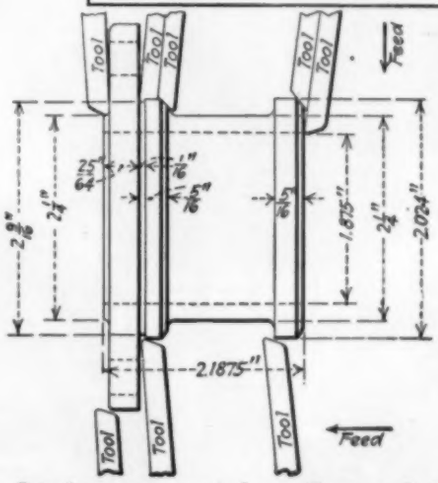
Drive pinion, alloy-steel forging—1st operation—Turn and face stem and taper; 5 turning tools; 6 facing tools; 65 ft. per min. Feed 0.014 in. per rev. 2nd operation—Turn and face gear end; 65 ft. per min. Total time 2.25 minutes.



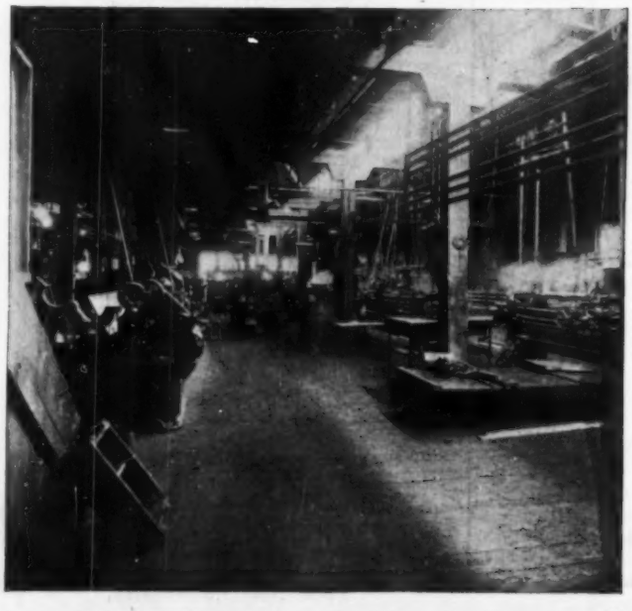
Transmission gear, alloy-steel forging 1st operation—Rough turn and face; 2 turning tools, 6 facing tools; 65 ft. per min. Feed 0.020 in. per rev. 2nd operation—Finish turn and face; 95 ft. per rev. Feed 0.014 in. per rev. Total time 1.5 minutes.



Ball and socket joint—1st operation—Rough turn and face; 1 turning tool, 2 facing tools; 65 ft. per min. Feed 0.032 in. per rev. 2nd operation—Finish turn and face; 1 turning tool, 2 facing tools; 125 ft. per min. Feed 0.022 in. per rev. Total time 2.7 minutes.

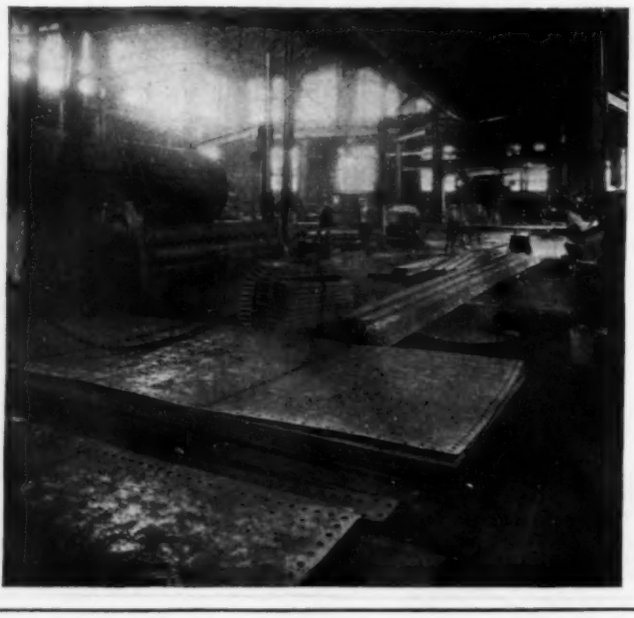


Bearing cage, cast iron—Turn and face; 3 turning tools, 5 facing tools; 95 ft. per min. Feed 0.016 in. per rev. Time 1.25 minutes.



Machine Tools in a Meat Packing Plant

Photographs by courtesy of Swift & Company



American Standard Screw Threads—I

For bolts, machine screws, nuts and commercially tapped holes. Approved by the American Engineering Standards Committee, May, 1924. Sponsored by S. A. E. and A. S. M. E.

THIS report contains tables, information, etc., selected from the Progress Report of the National Screw Thread Commission, as applying to Screw Threads for bolts, machine screws, nuts, tapped holes, etc., for general use. The changes are in agreement with the National Screw Thread Commission and will be incorporated in the forthcoming revision of its report. The classes of fit have been renamed and renumbered for the sake of clearness and simplicity; the standard length of engagement has been made equal to the nominal diameter in order to deal more consistently with variations in lead; the minimum major diameter of the nut and the maximum major diameter of the screw are made basic; certain classes and sizes which may now have a limited use but which it is expected will later become obsolete are in the appendix; and provision is made such that but two sets of taps and plug gages are required for a given diameter and pitch as the major and minor diameter tolerances for nuts of the free fit class have been used for all classes.

Report on Gaging Is Coming

The section of the N.S.T.C. report dealing with screw thread gages and gaging has been given careful consideration by the Sectional Committee and it has decided not to specify as standard any one definite method of screw-thread gaging. A report on this subject will shortly be issued by the Committee which will aim to establish, as far as possible, the fundamentals of screw-thread gaging.

Though its third purpose has not yet been attained, the Sectional Committee hopes that further steps may be taken by mutual concessions which result in bringing together the Whitworth and the American systems of threads so as to insure interchangeability in the English speaking world. The Committee also looks forward to the time when, by conferences with the standardization associations of the countries using the metric system, agreements along similar lines for fits and tolerances for metric threads will be brought about.

Terminology

The following definitions are given of the more important terms. Definitions of terms which are obviously elementary in character are intentionally omitted.

Terms Relating to Screw Threads

Screw Thread. A ridge of uniform section in the form of a helix on the external or internal surface of a cylinder or cone.

External Thread. An external thread is a thread on the outside of a member.

Internal Thread. An internal thread is a thread on the inside of a member.

Major Diameter. The largest diameter of a screw thread. The term "major diameter" replaces the term "outside diameter" as applied to the thread of a screw and also the term "full diameter" as applied to the thread of a nut.

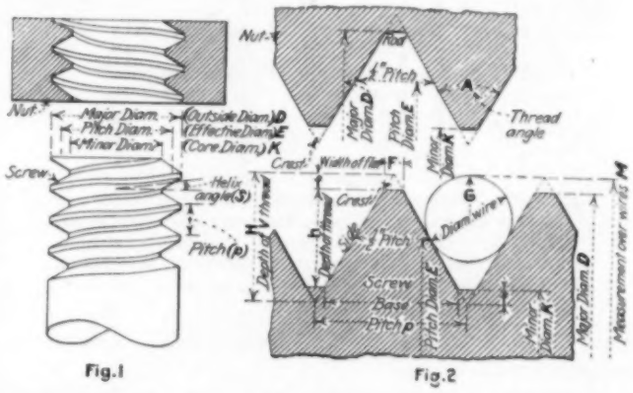
Minor Diameter. The smallest diameter of a screw thread. The term "minor diameter" replaces the terms "core diameter" and "root diameter" as applied to the thread of a screw and also the term "inside diameter" as applied to the thread of a nut.

Pitch Diameter. On a straight screw thread the diameter of an imaginary cylinder the surface of which would pass through the threads at such points as to make equal the width of the threads and the width of the spaces cut by the surface of the cylinder.

Pitch. The distance from a point on a screw thread to a corresponding point on the next thread measured parallel to the axis.

$$\text{Pitch (in inches)} = \frac{1}{\text{Number of threads per inch}}$$

Lead. The distance a screw thread advances axially in one turn. On a single-thread screw, the lead and



Figs 1 and 2—Screw thread nomenclature illustrated

pitch are identical; on a double-thread screw, the lead is twice the pitch; on a triple-thread screw, the lead is three times the pitch, etc.

Angle of Thread. The angle included between the sides of the thread measured in an axial plane.

Helix Angle. The angle made by the helix of the thread at the pitch diameter with a plane perpendicular to the axis.

Crest. The top surface joining the two sides of a thread.

Root. The bottom surface joining the sides of two adjacent threads.

Side. The surface of the thread which connects the crest with the root.

Axis of a Screw. The longitudinal central line through the screw.

Depth of Thread. The distance between the crest and the root of thread measured normally to the axis.

Length of Engagement. The length of contact between two mating parts, measured axially.

Depth of Engagement. The depth of thread contact of two mating parts, measured radially.

Terms Relating to Classification of Fits

Basic. The theoretical or nominal standard size from which all variations are made.

Crest Clearance. Defined on a screw form as the space between the crest of a thread and the root of its mating thread.

Allowance. An intentional difference in the dimensions of mating parts. It is the minimum clearance or the maximum interference which is intended between mating parts.

Tolerance. The amount of variation permitted in the size of a part.

Neutral Zone. A positive allowance. (See "Allowance.")

Limits. The extreme permissible dimensions of a part.

Fit. The relation between two mating parts with reference to ease of assembly; for example, wrench fit, close fit, medium fit, free fit. The quality of fit is dependent upon both the relative size and the quality of finish of the mating parts.

Finish. The character of the surface on a screw thread.

Table 1 The Two Thread Series

1	2	3	4
Sizes	Basic Major Diameter (Inches)	Coarse Series Threads per Inch	Fine Series Threads per Inch
0	0.0600	..	80
1	0.0730	64	72
2	0.0860	56	64
3	0.0990	48	56
4	0.1120	40	48
5	0.1250	40	44
6	0.1380	32	40
8	0.1640	32	36
10	0.1900	24	32
12	0.2160	24	28
1/4	0.2500	20	28
5/16	0.3125	18	24
3/8	0.3750	16	24
7/16	0.4375	14	20
1/2	0.5000	13	20
9/16	0.5625	12	18
5/8	0.6250	11	18
3/4	0.7500	10	16
7/8	0.8750	9	14
1	1.0000	8	14
1 1/8	1.1250	7	12
1 1/4	1.2500	7	12
1 1/2	1.5000	6	12
1 3/4	1.7500	5	12[1]
2	2.0000	4 1/2	12[1]
2 1/4	2.2500	4 1/2	12[1]
2 1/2	2.5000	4	12[1]
2 3/4	2.7500	4	12[1]
3	3.0000	4	10[1]

[1] These pitches are suitable for work requiring short engagement where it is not practical to specify tolerances for all conditions. They are not, therefore, included in the succeeding tables.

Dimensional Symbols

For use in formulas for expressing relations of screw threads and for use on drawings and for similar purposes the following dimensional symbols should be used:

Major diameter.....*D*
Corresponding radius.....*d*
Pitch diameter.....*E*
Corresponding radius.....*e*
Minor diameter.....*K*
Corresponding radius.....*k*
Angle of thread.....*A*
One-half angle of thread.....*a*
Number of turns per inch.....*N*
Number of threads per inch.....*n*

Lead.....$L = \frac{1}{N}$

Pitch or thread interval.....$p = \frac{1}{n}$

Helix angle.....*s*

Tangent of helix angle...$S = \frac{L}{3.14159 \times E}$

Width of basic flat at top crest or root.....*F*
Depth of basic truncation.....*f*
Depth of sharp V-thread.....*H*
Depth of American (National) form of thread.....*h*

Symbols for Wire Measurements

Measurement over wires.....*M*
Diameter of wire.....*G*
Corresponding radius.....*g*

Identification Symbols

These are for use on correspondence, drawings, shop and store-room cards, specifications for parts, taps, dies, gages, etc., and on the tools and gages themselves.

The basis of the system is the initial letters of the series, preceded by the diameter in inches (or the screw number) and number of threads per inch followed by the classification of fit all in Arabic characters. If the thread is left-hand the symbol "L.H." shall follow the number of threads. No symbol is used to distinguish right-hand threads.

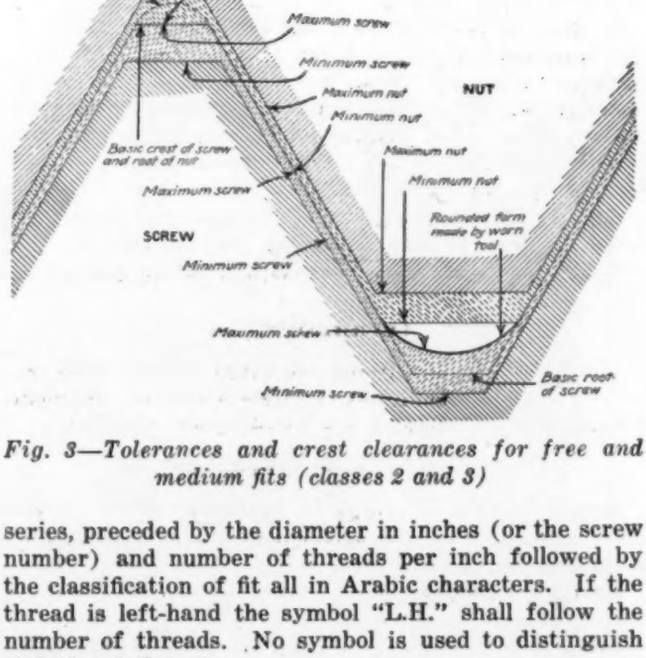


Fig. 3—Tolerances and crest clearances for free and medium fits (classes 2 and 3)

EXAMPLES: MARK

American (National) Coarse-Thread System: To specify a threaded part 1 inch in diameter, 8 threads per inch, and Class 2 fit. 1"-8-NC-2

American (National) Fine-Thread System: A threaded part 1 inch in diameter, 14 threads per inch, left-hand thread, and Class 4 fit ..... 1"-14-LH-NF-4

American (National) Form, Special Pitch: A threaded part 1 inch in diameter, 12 threads per inch, and Class 3 fit..... 1"-12-N-3

NOTE: The number of threads per inch must be indicated in all cases, irrespective of whether it is the standard number of threads for that particular size of threaded part or special.

Form of Thread

The form of thread profile as specified herein, and known previously as the United States Standard or Sellers' Profile, is adopted and shall hereafter be known as the American (National) Form of Thread.

The American (National) form of thread profile shall be used wherever possible for screw-thread work.

Specifications. The basic angle of thread between the sides of the thread measured in an axial plane shall be 60 degrees. The line bisecting this 60-deg. angle shall be perpendicular to the axis of the screw thread.

The basic width of flat at the root and crest of the thread form is found as follows:

$$F = \tfrac{1}{8} \times p \text{ or } 0.125 \times p$$

The basic depth of the thread form is found as follows:

$$h = 0.649519 \times p = \frac{0.649519}{n}$$

where p = pitch in inches

n = number of threads per inch.

Clearance in Nut at Minor Diameter. A clearance shall be provided at the minor diameter of the nut by removing the thread form at the crest by an amount between one-sixth and one-fourth of the basic thread depth.

Clearance in Nut at Major Diameter. A clearance at the major diameter of the nut shall be provided by decreasing the depth of the truncation triangle any desired amount down to one-third of its theoretical value.

Thread Series Adopted

Two thread series are adopted—a coarse and a fine. The Coarse-Thread Series is the present "United States Standard" supplemented in the sizes below one-fourth inch by a part of the standard established by the American Society of Mechanical Engineers (A.S.M.E.) in 1907. The Fine-Thread Series ($\frac{1}{4}$ inch to $1\frac{1}{2}$ inches inclusive) is in accordance with the present "Regular Screw-Thread Series of the S.A.E. Standard for Screw-Threads" established by the Society of Automotive Engineers (S.A.E.) in 1911, supplemented in sizes below one-fourth inch by the Fine-Thread Series established by the American Society of Mechanical Engineers (A.S.M.E.).

These two series are specified in Table 1.

Classification of Fits

There are established herein for general use four distinct classes of screw-thread fits as specified in the following brief outline. The examples given under each class of fit are for the purpose of illustration only.

Loose Fit (Class 1). Recommended as a commercial standard for tapped holes in the numbered sizes only. May be used with screws of other classes to obtain quality of fit desired. (See Appendix C.)

Free Fit (Class 2). Includes the great bulk of screw-thread work of ordinary quality of finished and semi-finished bolts and nuts, etc. (Called "Medium Fit Regular" in the N.S.T.C. "Progress Report.")

Table 2 Loose Fit (Class 1)

Allowances and Tolerances for Nuts (See also Appendix C)

1	2	3	4	5
Threads per Inch	Allowances on Nut (Inches)	Pitch Diameter Tolerances[1] (Inches)	Lead Tolerances[1,2] (Inches)	Tolerances in ½ Angle (Deg. Min.)
80	0.0000	0.0024	0.0007	3—40
72	0.0000	0.0025	0.0007	3—26
64	0.0000	0.0026	0.0008	3—10
56	0.0000	0.0028	0.0008	3—0
48	0.0000	0.0031	0.0009	2—50
44	0.0000	0.0032	0.0009	2—41
40	0.0000	0.0034	0.0010	2—36
36	0.0000	0.0036	0.0010	2—28
32	0.0000	0.0038	0.0011	2—19
28	0.0000	0.0043	0.0012	2—18
24	0.0000	0.0046	0.0013	2—6

[1]The tolerances specified for pitch diameter in Column 3 are cumulative, and include all errors of lead and angle. The full tolerance on pitch diameter is therefore not available unless the lead and angle of the thread are perfect. Columns 4 and 5 give, for information, the error in lead (per length of thread engaged) and in angle, respectively, which can each be compensated for by half the tolerance on pitch diameter shown in Column 3. If lead and angle error both exist to the amount tabulated, the pitch diameter of a bolt, for example, must be reduced by the full tolerance or it will not enter a basic nut or gage nor is the full tolerance available unless the gage be perfect. If no lead error existed on such a bolt, the angle error could be twice that given, and vice versa; but these extreme conditions are not contemplated as being desirable. (See report on "Gages and Gaging of Screw Threads" and Appendix B.)

[2]Variation in lead between any two threads not farther apart than the length of engagement.

Table 3 Free Fit (Class 2)

Allowances and Tolerances for Screws and Nuts

1	2	3	4	5
Threads per Inch	Allowances (Inches)	Pitch Diameter Tolerances[1] (Inches)	Lead[1] Tolerances[2] (Inches)	Tolerances in ½ Angle[1] (Deg. Min.)
80	0.0000	0 0017	0.0005	2—36
72	0.0000	0 0018	0.0005	2—28
64	0.0000	0.0019	0.0005	2—19
56	0.0000	0.0020	0 0006	2—8
48	0.0000	0.0022	0 0006	2—1
44	0.0000	0.0023	0.0007	1—56
40	0.0000	0.0024	0.0007	1—50
36	0.0000	0.0025	0 0007	1—43
32	0.0000	0.0027	0 0008	1—39
28	0.0000	0.0031	0.0009	1—39
24	0.0000	0.0033	0.0010	1—31
20	0.0000	0.0036	0 0010	1—22
18	0.0000	0.0041	0 0012	1—25
16	0.0000	0.0045	0.0013	1—22
14	0.0000	0.0049	0 0014	1—19
13	0.0000	0.0052	0 0015	1—17
12	0.0000	0.0056	0.0016	1—17
11	0.0000	0.0059	0.0017	1—14
10	0.0000	0.0064	0.0018	1—13
9	0.0000	0.0070	0.0020	1—12
8	0.0000	0.0076	0.0022	1—10
7	0.0000	0.0085	0.0025	1—8
6	0.0000	0.0101	0.0029	1—9
5	0.0000	0.0116	0.0033	1—6
4½	0.0000	0.0127	0.0037	1—5
4	0.0000	0.0140	0.0040	1—4

[1] and [2]. See notes under Table 2.

Medium Fit (Class 3). Includes the better grade of interchangeable screw-thread work, such as automobile bolts and nuts. (Called "Medium Fit Special" in N.S.T.C. "Progress Report.")

Close Fit (Class 4). Includes screw-thread work requiring a fine snug fit, somewhat closer than the medium fit, such as high-grade aircraft parts, etc. In this class of fit selective assembly of parts may be required. It is not considered practicable as a commercial standard for tapped holes of the numbered sizes.

Table 4 Medium Fit (Class 3)

Allowances and Tolerances for Screws and Nuts

1	2	3	4	5
Threads per Inch	Allowances (Inches)	Pitch Diameter Tolerances[1] (Inches)	Lead[1] Tolerances[2] (Inches)	Tolerances in 1/2 Angle[2] (Deg.Min.)
80	0.0000	0.0013	0.0004	1—59
72	0.0000	0.0013	0.0004	1—47
64	0.0000	0.0014	0.0004	1—43
56	0.0000	0.0015	0.0004	1—36
48	0.0000	0.0016	0.0005	1—28
44	0.0000	0.0016	0.0005	1—23
40	0.0000	0.0017	0.0005	1—18
36	0.0000	0.0018	0.0005	1—14
32	0.0000	0.0019	0.0005	1—10
28	0.0000	0.0022	0.0006	1—11
24	0.0000	0.0024	0.0007	1—6
20	0.0000	0.0026	0.0008	1—0
18	0.0000	0.0030	0.0009	1—2
16	0.0000	0.0032	0.0009	0—59
14	0.0000	0.0036	0.0010	0—58
13	0.0000	0.0037	0.0011	0—55
12	0.0000	0.0040	0.0012	0—55
11	0.0000	0.0042	0.0012	0—53
10	0.0000	0.0045	0.0013	0—52
9	0.0000	0.0049	0.0014	0—51
8	0.0000	0.0054	0.0016	0—50
7	0.0000	0.0059	0.0017	0—47
6	0.0000	0.0071	0.0020	0—49
5	0.0000	0.0082	0.0024	0—47
4 1/2	0.0000	0.0089	0.0026	0—46
4	0.0000	0.0097	0.0028	0—44

[1] and [2]. See notes under Table 2.

A Second Method of Obtaining Medium Fit (Class 3)

A detailed examination of the tolerances given in Tables 3, 4 and 5 will indicate that the same quality of fit as given by Medium Fit screws and threaded holes can be obtained by using screws to Close Fit tolerances in holes made to Free Fit tolerances, or vice versa. The general adoption of this practice will reduce the variety of taps, gages, threaded parts, etc., required to be carried in stock. However, the combination of Free and Close Fits should be used in place of Medium Fit only when the substation is understood and agreed to by all parties concerned.

Special Conditions

Conditions Requiring Special Fits. In cases, where looser fits are required than those given by the above-named classes, the use of the Loose Fit of the National Screw Thread Commission is recommended.

Special Pitch and Diameter Combinations. In general the tables given are intended for use with the two standard thread series only. The application of fine pitches to large diameters involves questions of workmanship which affect the grade of fit chosen.

When a pitch of thread is used with a diameter not called for in a standard thread series, it shall be defined as of "American (National) Form," but not as "American Standard."

General Specifications

The following general specifications will apply to all classes of fit specified in the body of the report. For special specifications applying to the Loose Fit class see Appendix C.

Uniform Minimum Nut. The pitch diameter of the minimum threaded hole or nut corresponds to the basic size, variations being permitted above the basic size. The major and minor diameters of the minimum nut are also uniform for all classes of fit.

Uniform Tap Drill Sizes. The maximum and minimum minor diameters and the consequent minor diameter tolerances are the same for all nuts of a given size for all classes of fit. This permits uniform tap drill sizes for all classes of fit.

Uniform Major and Minor Diameter of Screws. The maximum and minimum major and minor diameters are the same for all screws of a given size for all classes of fit herein tabulated.

Length of Engagement. The tolerances herein determined are based on a length of engagement not to exceed the nominal or major diameter of the screw. Where greater lengths of engagement are required a corresponding increase in the accuracy of lead and thread form is necessary, which may be obtained by the provision of selection of more accurate threading tools, and the use of longer "Go" gages.

Rounded Root Forms. The crest clearances allowed are such as to permit rounded root forms in both nut and screw. These may be formed either by tools purposely rounded or rounded as a result of wear in use. For the limits of this permissible rounding see Pars. 6 and 7.

Definitions

Loose Fit (Class 1). This class of screw threads is, in this report, recommended for use in tapped holes in the *numbered sizes only*. For such use it will be defined and specified as follows:

Minimum Nut is Basic.

Direction of Tolerance on Nut: The tolerance on the nut will be plus.

Tolerance Values: The tolerances for a nut of a given pitch will be as specified in Table 2.

Free Fit (Class 2). This class of screw threads will be defined and specified as follows:

Minimum Nut is Basic.

Maximum Screw is Basic.

Direction of Tolerance on Nut: The tolerance on the nut will be plus.

Direction of Tolerance on Screw: The tolerance on the screw will be minus.

Zero Allowance: The allowance between the pitch diameter of the maximum screw and minimum nut will be zero for all pitches and all diameters.

Tolerance Values: The tolerances for a screw or nut of a given pitch will be as specified in Table 3.

Medium Fit (Class 3). This class of screw threads will be defined and specified as follows:

Minimum Nut is Basic.

Maximum Screw is Basic.

Direction of Tolerance on Nut: The tolerance on the nut will be plus.

Direction of Tolerance on Screw:[1] The tolerance on the screw will be minus.

Zero Allowance: The allowance between the pitch diameter of the maximum screw and the minimum nut will be zero for all pitches and all diameters.

Tolerance Values: The tolerances for a screw or nut of a given pitch will be specified in Table 4.

Close Fit (Class 4). This class of screw threads will be defined and specified as follows:

Minimum Nut is Basic.

Maximum Screw is Above Basic: The major diameter and pitch diameter of the maximum screw will

Table 5 Close Fit (Class 4)

Allowances and Tolerances for Screws and Nuts

1	2	3	4	5
Threads per Inch	Interference or Negative Allowances (Inches)	Pitch Diameter Tolerances[1] (Inches)	Lead[1] Tolerances[2] (Inches)	Tolerances in ½ Angle[1] (Deg.Min.)
80	0.0001	0.0006	0.0002	0—55
72	0.0001	0.0007	0.0002	0—58
64	0.0001	0.0007	0.0002	0—51
56	0.0002	0.0007	0.0002	0—45
48	0.0002	0.0008	0.0002	0—44
44	0.0002	0.0008	0.0002	0—40
40	0.0002	0.0009	0.0003	0—41
36	0.0002	0.0009	0.0003	0—37
32	0.0002	0.0010	0.0003	0—37
28	0.0002	0.0011	0.0003	0—35
24	0.0003	0.0012	0.0003	0—33
20	0.0003	0.0013	0.0004	0—30
18	0.0003	0.0015	0.0004	0—31
16	0.0004	0.0016	0.0005	0—29
14	0.0004	0.0018	0.0005	0—29
13	0.0004	0.0019	0.0005	0—28
12	0.0005	0.0020	0.0006	0—28
11	0.0005	0.0021	0.0006	0—26
10	0.0006	0.0023	0.0007	0—26
9	0.0006	0.0024	0.0007	0—25
8	0.0007	0.0027	0.0008	0—25
7	0.0008	0.0030	0.0009	0—24
6	0.0009	0.0036	0.0010	0—25
5	0.0010	0.0041	0.0012	0—23
4½	0.0011	0.0044	0.0013	0—23
4	0.0013	0.0048	0.0014	0—22

[1] and [2]. See notes under Table 2.

be above dimensions by the amount of the negative allowance (interference) specified in Table 5.

Direction of Tolerance on Nut: The tolerance on the nut will be plus.

Direction of Tolerance on Screw: The tolerance on the screw will be minus.

Allowance Values: The negative allowance (interference) provided between the pitch diameter of the minimum nut, which is basic, and that of the maximum screw, which is above basic will be as specified in Table 5.

Tolerance Values: The tolerance for a screw or nut of a given pitch will be as specified in Table 5.

Tolerances

Tolerances Represent Extreme Variations. The tolerances as hereinafter specified are for the classes of fit listed in the body of the report, and represent the extreme variations allowed on the work. (See Appendix A, Section 2.)

Pitch Diameter Tolerances. These are derived from the pitch of the thread instead of from the diameter. The method of derivation is explained in Appendix A.

Pitch Diameter Tolerances Include Lead and Angle Variations. The relations between these quantities are expressed by Columns 4 and 5 of Tables 2, 3, 4 and 5 and are explained by the note at the bottom of each table; see also Appendix B.

These relations may be automatically insured by using a "Go" gage of the length of engagement required, or by projecting an equivalent length of thread on a suitable chart, or by so projecting a single thread constrained for the required length of engagement, or by any other means which preserves the mathematical relation between variations in pitch diameter, lead and form.

Pitch Diameter Tolerances on Screw Same as on Nut. The pitch diameter tolerances provided for a screw of a given class of fit will be the same as the pitch diameter tolerances provided for the corresponding nut of the same class of fit.

Tolerances on Major Diameter of Screw Twice Pitch Diameter of Tolerances for Free Fit. The allowable tolerances on the major diameter of screws of all classifications will be twice the tolerance value allowed on the pitch diameters of screws of the Free Fit (Class 2).

Tolerances on Minor Diameter of Screw. The minimum minor diameter of a screw of a given pitch will be such as to result in a basic flat ($\frac{1}{8} \times p$) at the root.

The maximum minor diameter is that which would result from the use of a threading tool, set at the maximum pitch diameter, whose point has been worn or ground back from the basic outline by an amount equal to one-eighteenth of the basic depth of engagement (one-eighteenth h or 0.03684 p). It is permissible that the resulting root line shall be rounded. In no case, however, should the form be such as to cause the screw to be rejected on the minor diameter by a "Go" ring gage, the minor diameter of which is equal to the minimum minor diameter of the nut.

Tolerances on Major Diameter of Nut. The maximum major diameter of the nut of a given pitch will be such as to result in a flat one-third of the basic flat ($\frac{1}{4} \times p$).

The nominal minimum major diameter of the nut equals the basic major diameter. In practice a clearance is provided to facilitate manufacture by permitting a slight rounding or wear at the crest of the tap. In no case, however, should the outline resulting from a worn tap or cutting tool be such as to cause the nut to be rejected on the major diameter by a "Go" plug gage made to basic form and dimensions at the crest.

Tolerances on Minor Diameter of Nut. The tolerances on minor diameter of a nut of a given pitch will be one-sixth of the basic thread depth regardless of the class of fit being produced. ($\frac{1}{6} h$ or 0.10825 p.) The maximum and minimum minor diameters are determined by the conditions set forth in the last two paragraphs under "Form of Thread." In the case of a punched hole the average diameter of the hole shall govern.

(To be continued)

[1] The maximum minor diameter of the screw is above the basic minor diameter.

Australia, the largest foreign market for American automotive products, bids fair to exceed all previous records in purchases of motor vehicles this year, according to *Commerce Reports* published by the Department of Commerce. During the first six months of 1924, four-fifths as many passenger cars were shipped to Australia from the United States as during 1923.

Solid and Hollow Shafts

By L. F. Southwick

It is generally known that a hollow shaft may be designed to be of the same torsional strength as that of a given solid shaft, but of less weight. The relation between the diameter of the solid shaft and the inner and outer diameters of the hollow shaft, for the condition of equal torsional strength, is less generally known. It is:

$$D^3 = \frac{d_1^4 - d_2^4}{d_1}$$

where D = diameter of solid shaft;
d_1 = outside diameter, hollow shaft;
d_2 = inside diameter, hollow shaft.

Inspection of the formula will show that in any solid shaft, there exists an infinite number of hollow shafts. If, then, the outside diameter is decided upon, the inside diameter may be computed. If, however, the inside diameter is assumed, it is not an easy matter to solve the formula for the outside diameter, the trial-and-error method or that of synthetic division being the only ones available.

The accompanying chart will solve the formula for any variable, being given any other two, by merely laying a straightedge across the two scales at the given values, the intersection of the straightedge with the remaining scale giving the required answer. The smaller inserted chart is for small values of the variables and includes a somewhat greater subdivision than the larger chart, giving more accuracy for smaller shafts.

It is important that the chart be flat while it is being used. A stretched thread makes a convenient straightedge, since it does not hide any figures. A piece of paper, however, or a ruler may be used.

Directions for constructing charts of this kind and others can be found in "The Design of Diagrams for Engineering Formulas" by Hewes and Seward.

Ammunition Making in 1923

The Department of Commerce announces that, according to data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of ammunition and related products reported a total output valued at $51,508,622, of which amount $4,549,651 represents commodities other than ammunition and related products. The rate of increase in the total as compared with 1921, the last preceding census year, was 52.9 per cent, while the rate of increase in the value of ammunition and related products was 62.5 per cent. This classification covers establishments manufacturing small-arms ammunition, blasting and detonating caps, safety fuses, miners' squibs, railroad torpedoes, etc.

In addition, a relatively small amount of ammunition, etc., was manufactured by establishments engaged primarily in other industries. The value of such commodities thus produced outside the industry proper in 1921 was $994,918, an amount equal to 3.1 per cent of the total value of products reported for the ammunition industry from all factories engaged in its making.

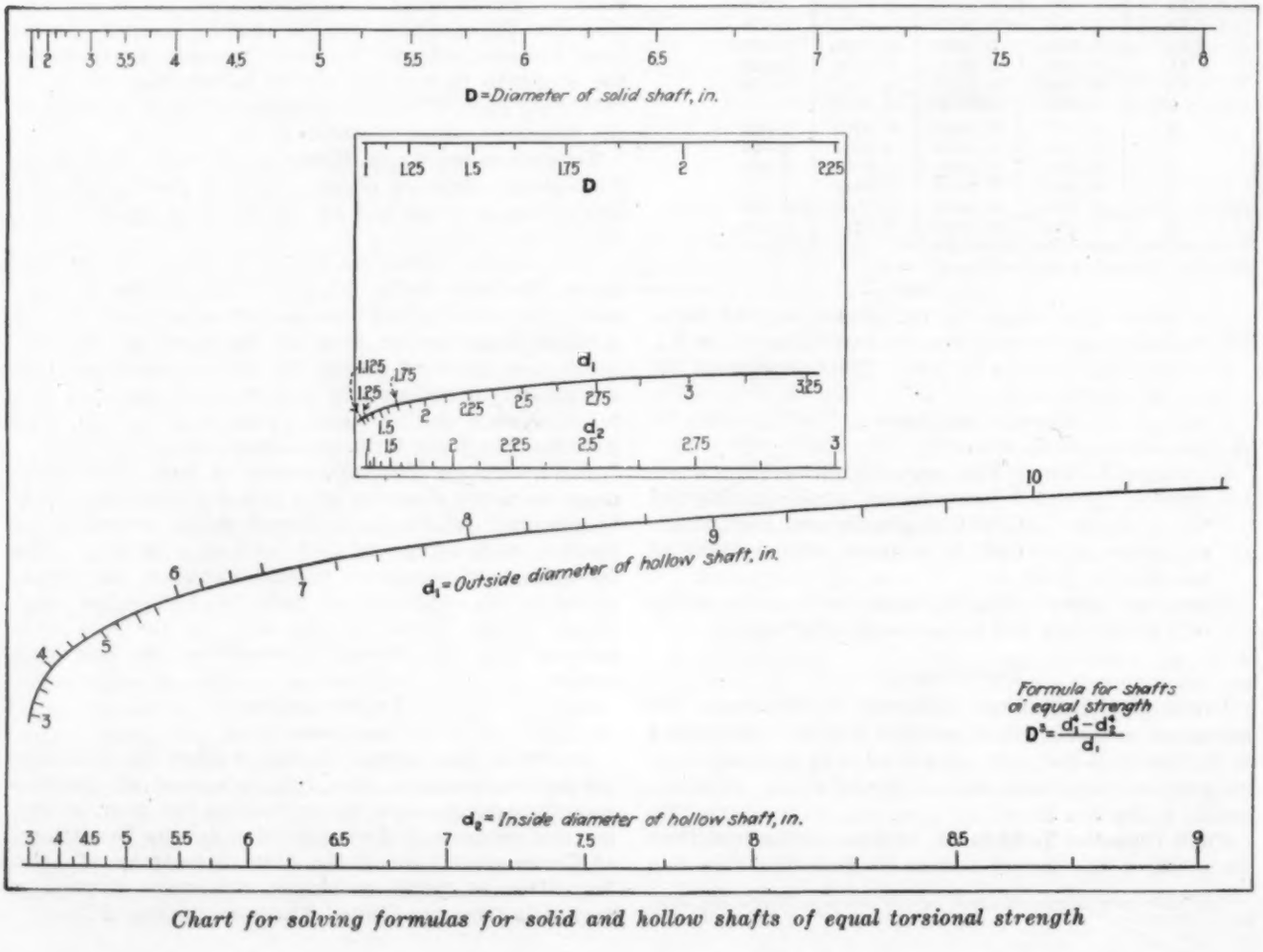


Chart for solving formulas for solid and hollow shafts of equal torsional strength

Routing and Handling Material
in Making a Quarter-Horsepower Motor

By L. C. Morrow
Managing Editor, *American Machinist*

Winding—Connecting wound stators—How the stators are handled through the baking oven—The use of conveyors in winding, connecting and in assembling

UP TO this point in the story the housing has been completed; the rotor has been completed except for the pressing-in of the shaft and the application of the switch and fan; and the stator core has been prepared for the winding. To complete the wound-stator unit, it is necessary to apply the coils and wiring. The layout on the wiring, assembly and testing floor, one story above the machining department, provides for movement of the work from one end of the space to the other and back. For this reason it will be necessary to refer next to Fig. 18, the last illustration, which shows at the left the operators making the coils and the machines on which they are made.

The first part of the article contains the statement that judicious use has been made of conveying equipment as well as other forms of transportation. The first conveyor is introduced in the next operations, applying the coils to the stator cores, Fig. 13, and making the connections, Fig. 14. Coils are delivered to the two rows of girls at the benches along the conveyor belt. Stator cores are placed on the belt and as they travel, each girl removes from the belt and places on the bench enough cores to keep her supplied for some time. When she has finished her part of the work, she places the core, with coils assembled, back on the belt, by which it is conveyed to the inspector at the end of the bench.

The winding operation is divided into two parts, assembling the coils and making connections. After each division the work is inspected, in the one case for grounds and in the other for imperfect connections.

After inspection, the wound stators are placed on the suspended racks shown in Fig. 15, and pushed into the oven shown in the same illustration. They are preheated in one side of the oven for a period of two hours, at a temperature of 110 deg. C., to eliminate moisture. They are then passed on through the first side of the oven, taken from the racks, dipped into impregnating varnish, drained, replaced on the racks and pushed (from the far end in the illustration) into the second side of the oven, where they are baked at 115 deg. C. for ten hours.

In a position near the ovens, the housings are standing on trucks, where they have been delivered from the enameling oven mentioned previously. They are given the operations necessary after enameling: the brackets are reamed, the name plates are applied and the terminal posts are put on. Distant a few feet from the location of these operations the assembly begins. Transportation from operation to operation and to assembly is by hand truck.

Several operations remain to be done on the stator and rotor before they will be ready for assembly. They

Fig. 13—Application of coils to stator cores (winding)

Cores are placed on the belt at the end of the benches to be conveyed to the operators. Finished work is conveyed on the belt to the inspectors.

Concluding part of the article. The preceding part appeared on page 333.

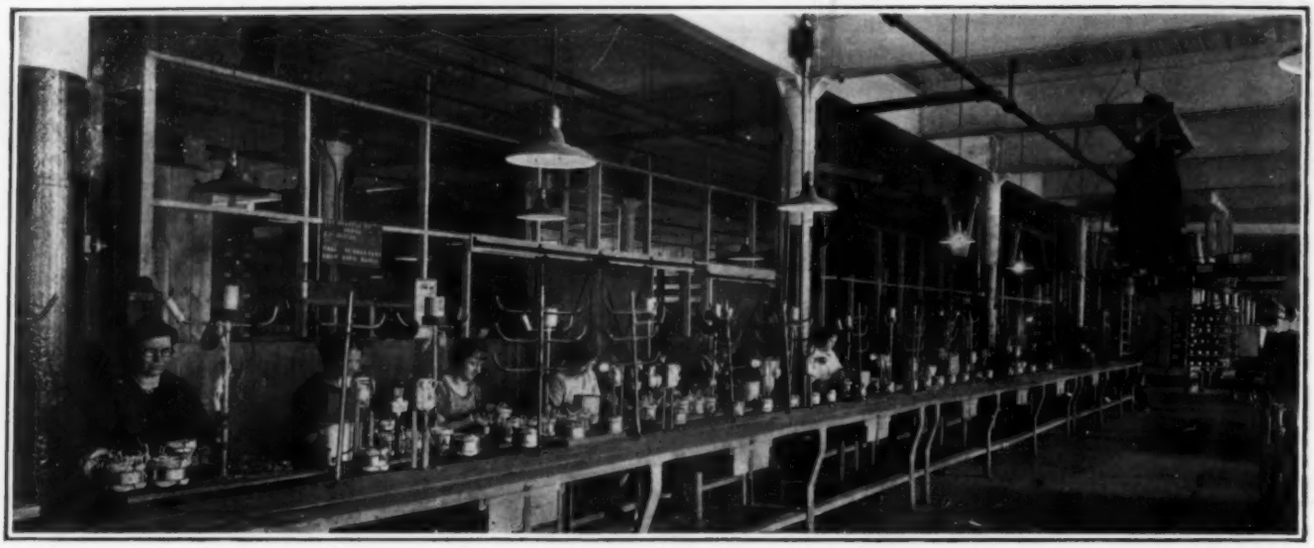


Fig. 14—Connecting wound stators

Parts to be worked on are taken from the conveyor and completed work is returned to it, to be carried to the inspectors. This operation follows that of applying the coils to the stator cores, shown in Fig. 13.

Fig. 15—Baking oven for stators

The stators are dried in one side of the oven, then dipped and drained, after which they are baked in the other side. The temperatures are 110 and 115 deg. C. Drying time is 2 hours, baking time 10 hours.

Fig. 16—Machine group for operations on assembled stators

On these machines the inside of the stator is ground. Fans are pressed on the shafts and the shafts are pressed into the rotors on the pneumatic press. Then switches are applied and rotors balanced.

are performed either on the group of machines shown in Fig. 16 or on benches across the aisle. The stator is pressed into the frame by means of an arbor press and the inside of the stator is then ground on the Heald internal grinders shown. The shafts are pressed into the rotors and the fans are pressed on in one operation in the pneumatic press included in the group illustrated. Switches are applied, and the assembled rotors are balanced. Assembly is the next operation and it is a very simple one, since the machine work has been so accurate that no fitting is necessary.

A good idea of the layout of the parts-assembly department may be had from Fig. 17. If the picture were to continue to the left, the beginning of the assembly bench would be seen. The assembled and balanced rotors are allowed to roll down the incline just back of the inspection bench along the wall to the assemblers. Four men assemble 500 motors per day of 8¾ hr. The operation includes assembling the switch to the bracket and the rotor into the housing, making all necessary connections to prepare the motor for final inspection and test. Below the incline is a belt conveyor, by which the assembled motors are carried to the inspectors, and which carries them from station to station, the full length of the department, to the final-test floor shown in Fig. 18. The right-hand portion of Fig. 17 shows the assembly of the rotor and stator switch, which is assembled in progressive operation. Final inspection of this unit is given at the end of the bench, which is approximately three feet from the place where the unit is assembled to the motor.

It should be noted that the routing is of the straight-line variety. Parts are brought together with nicety at one end of the second, or assembly floor, where they are put together to make the completed motor. The motors are then conveyed to the testing department, receiving certain inspections on the way. After being tested the motors receive a visual inspection and are prepared, at the end of the inspection bench, for shipment. They are packed in paper cartons, a Standard

Fig. 17—Switch assembly, motor assembly and motor inspection

Assembled rotors roll down the incline to the assembly bench. A belt conveyor, below the incline, carries the assembled motors to the inspectors' benches and from them to the testing department.

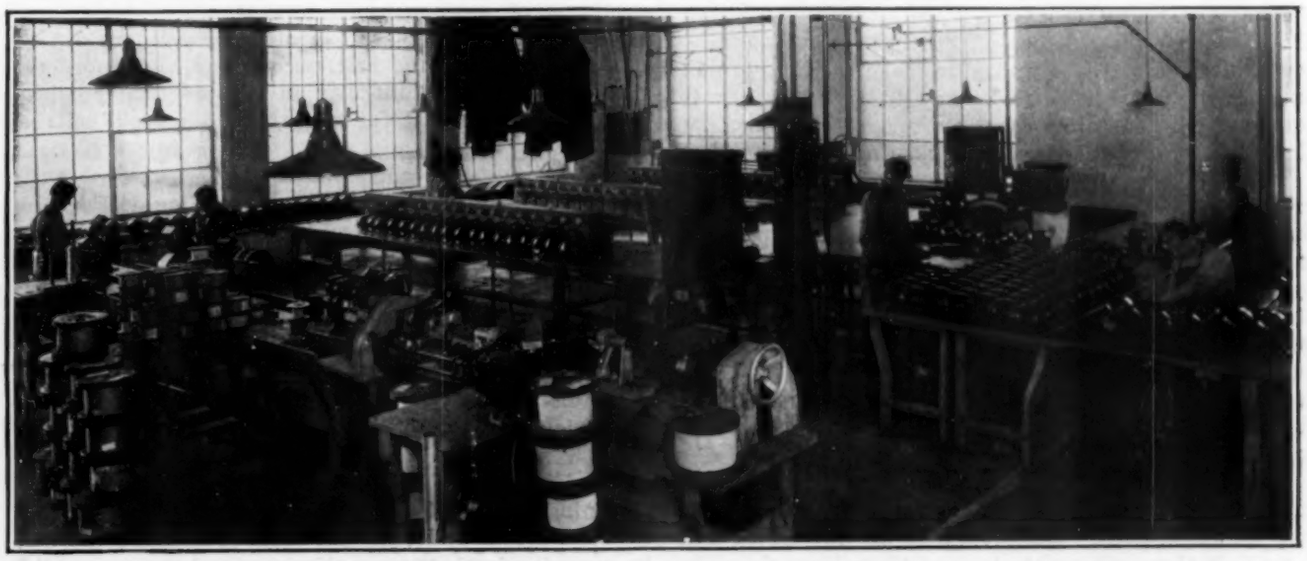


Fig. 18—Test floor

The motors are taken from the conveyor belt, seen in the extreme left of the illustration and put through the several tests. To the right of the testing department is the wrapping and boxing department.

sealing machine being used, and are then placed in wooden crates. Six motors are packed in each crate. Marking of the crates is done at once, and in this way shipment is made direct from the assembly floor.

There are many operations in machining the parts for the ¼-hp. motor that it would be worth while to describe in detail. However, the article is written to emphasize economical layout and routing, and the balanced use of conveyors, and space limits do not permit taking up other details. It is thought that by a careful study of the floor diagram and the halftones, a fairly complete understanding may be had of the economies in time, floor space and labor that are being practiced in the manufacture of the motor.

A Progressive Equipment Buyer —Discussion

By Frederick Franz
Consulting Engineer, New York City

Your editorial "A Progressive Equipment Buyer" in Vol. 61, No. 4 of *American Machinist*, brings up the point which is the nucleus of every decision regarding the purchase of any machinery that saves money. All the formulas available for calculating the economies of labor-saving machinery will not show whether or not it should be purchased.

Assuming that all the data that are necessary have been obtained, that all opinions are eliminated and only facts remain, the savings, in money, that a given investment, in money, will effect can be definitely calculated. But the nucleus of the decision is this, "How long will it take for the investment to pay for itself?" The purchaser bases his decision on the answer to this question.

I have collected a number of references to this matter. The time runs all the way from "a reasonable time, say of three months when the change is made as a matter of course" (Henry Ford in "My Life and Work") to six years for the time in which re-equipping U. S. Shipping Board vessels with Diesel engines will pay its cost. Those references that I feel I can trust run from two to three years.

The investment you mention was returned in less than a year. That is an exception to the general run of the machinery sold today. Further, just after having paid its cost, it was junked to make room for a real machine. Something better was in sight before it could actually earn any money. Under that condition the risk of investing the capital was not justified.

Two questions always come to my mind when I read or hear references to this subject. One is, "Why give purchasers the idea that a new machine must pay for itself in a year (and often much less) to justify its cost, by publishing only those remarkable examples?" The other is more along the lines of a questionnaire to managers and is "In how short a time must an improvement pay for itself in order to merit its purchase?" The class of industry questioned would undoubtedly affect the answer to this question. Perhaps your readers would be interested in it.

[Mr. Franz suggests that perhaps our readers may be interested in a time limit within which machines must pay for themselves. We know they *are* interested and hope that they will write some of their ideas for publication. Recently we had a statement from a manufacturer that two years is the time limit in his plant.—Ed.]

Book Reviews

Practical Mathematical Analysis. By H. von Sanden, Professor of Mathematics at the University of Clausthal, with examples by the translator, H. Levy, Professor of Mathematics, Imperial College of Science and Technology, London. Cloth binding, 195 pages, 6x9 in., illustrated. Published by E. P. Dutton & Co., 681 Fifth Ave., New York, N. Y. Price $4.50.

The average engineer or other person engaged in work of a technical nature, especially if such work be in the realm of research activities, usually has considerable difficulty in bridging the gap between the fundamental mathematical statement of a problem and the numerical result required for its solution. This book is intended to be of assistance on such occasions and is based on the courses in numerical and graphical calculation conducted at the University of Göttingen by Professor C. Runge.

After a chapter devoted to the general consideration of numerical and graphical calculations, the author takes up the general theory and use of the slide rule, together with the construction and availability of the calculating machine. Various methods of procedure and "tricks" in the manipulation of these instruments are explained.

Methods of solution for algebraic equations of a high order are given and should make possible a rapid approximate solution of such equations. For assistance in the consideration of curves, a sound mathematical basis for extrapolation and interpolation is laid down and followed by a chapter on mechanical quadrature, in which Simpson's rule and Gauss's method of integration are explained.

Graphical methods of integration are followed by procedure in finding analytical approximations to empirical functions. This material is of special importance for the experimental physicist and engineer, and the methods developed are satisfactory and sound.

The latter part of the book treats of the solution of equations of various kinds by various methods, and graphical and numerical integration of ordinary differential equations of the first, second and higher orders. For those who find difficulty in the practical application of mathematical fundamentals this book will be of value.

Official Report of the Eleventh National Foreign Trade Convention. Published by the Secretary, National Foreign Trade Convention, Headquarters, India House, Hanover Square, New York City. Four hundred and thirty-nine pages, 9x6 in.

The program and proceedings of the convention held in Boston, June 4, 5, 6, and 7 have been made into a very attractive book. All of the speeches and the discussions that followed are included. James A. Farrell, president of the United States Steel Corp. and chairman of the National Foreign Trade Council; Channing H. Cox, Governor of Massachusetts; Howard Coonley, president of the Walworth Manufacturing Co., Boston; Lewis E. Pierson, chairman of the board, the Irving Bank-Columbia Trust Co.; and many other noted men were among the speakers who attended this year's convention.

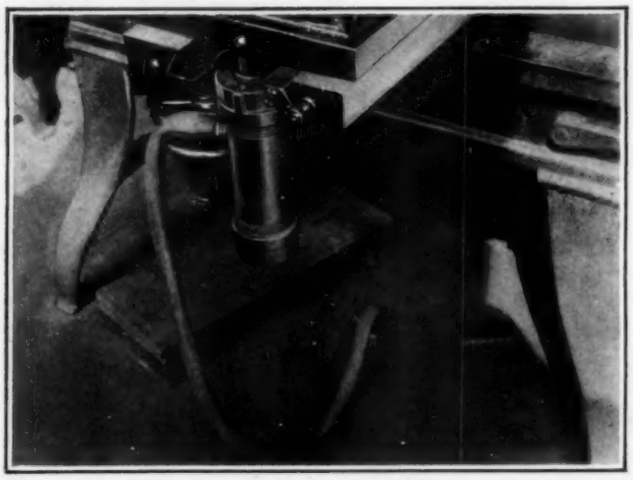
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Keeping Fine Chips Out of Circulation

BY WILLIAM DENTON

In the shop of the O. K. Tool Co., Shelton, Conn., all milling, drilling and other machines that require a stream of cooling liquid or cutting compound on the tools are supplied from a central tank, and the liquid



A trap for fine chips

from each machine drains back into the system through large conduits on each floor. This scheme does away with many petty annoyances due to a large number of small individual pumps and their tendency to get out of order, but unless special care is taken to keep chips out of the pipes it may cause trouble far in excess of the relief provided.

Large chips or curled shavings may be kept out with strainers. Fine particles of metal are bound to be entrained in the moving liquid and wherever the flow may be momentarily arrested the sediment will be deposited, choking pipes that are temporarily out of service, blocking open valves so that they cannot be closed, interfering with the action of pump valves and making trouble generally. The device shown in the illustration herewith was designed to give the fine chips time to settle before they reach a place where they can do harm.

The device is a short piece of 2-in. pipe, capped at both ends and having an inlet in the upper cap and an outlet in the side as near to the top as the upper cap will permit. The liquid flows into it from the pockets and channels around the table of the machine to which it is attached and flows out again through the flexible hose that leads to the conduit on the floor below. One of the devices is attached to each machine to which the liquid is delivered.

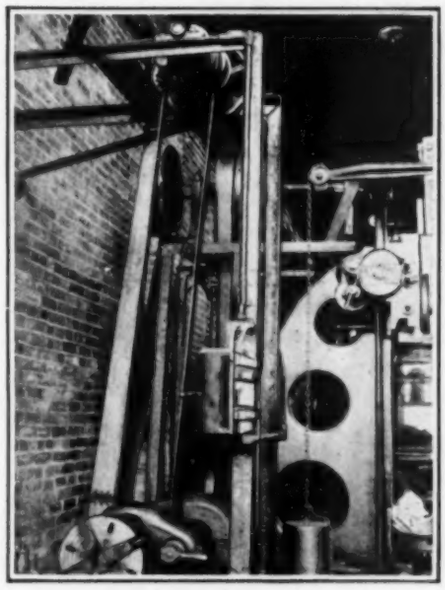
To continue with the liquid, the fine chips must make a right-angle turn without settling in the least below the level of the inlet, and this they will not do for the reason that when they are discharged into the relatively large volume of quiescent liquid in the pipe they begin to settle immediately.

The short length of 2-in. pipe will thus be filled with fine chips in the course of a few hours, and it is a part of the floorman's daily duties to unscrew the bottom cap and clean out the sediment.

Individual-Motor Drives in Jobbing Shops

BY CLIFFORD H. FRENCH

A recent visit to some of the modern shops of Norfolk, Va., revealed a rather unusual application of individual motor drives to various machines in jobbing shops. The motor supports in nearly all cases were built of steel angles of suitable sizes to support the motor. In the majority of shops the frames were bolted to the machine tools in some suitable manner. In others there was a frame built over the head of the machine, and fastened to both floor and wall, where possible, as in the illustration. Gearing seems to have been the favorite method of reducing the motor speed to secure the proper number of revolutions for the machine countershaft. In practically all cases the final drive was belting.



Geared motor drive in a job shop

Although unusual, the individual drive is particularly valuable in a jobbing shop. This kind of a shop has more occasion to run but a small number of its machines than the one which manufactures a regular line of work. And instead of driving the line shafts and all countershafts, where it is necessary to run nothing but the power hacksaw, only the power needed for the saw is required.

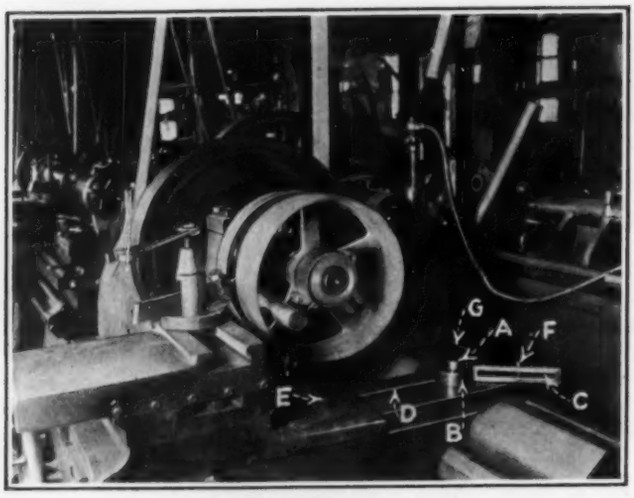
By this means a considerable saving in the cost of power is effected.

Pulley-Crowning Attachment for a Lathe

BY JACK WILLIAMS

The illustration shows an attachment for an engine lathe by means of which a crown face may be turned on any pulley of a diameter that will swing over the carriage, and of any reasonable width in proportion. The pulley is carried on a stud arbor in the spindle of the lathe and is driven by a stud in the faceplate. The tail center is used to support the outer end of the arbor, but is not shown in the picture, as the tailstock was moved out of the way so as not to obstruct the view.

The cross-feed screw is taken out of the carriage and all adjustments for diameter are made by the compound



A pulley crowning attachment

rest, which is clamped at zero position. The stud *A* is screwed into the bridge of the carriage at the bottom of the trough in which the cross-feed screw usually lies. The part *B* fits over and turns freely upon the stud *A*, and is one piece with the slotted lever *C* which extends toward the rear of the lathe and has a row of drilled holes equidistantly spaced along it.

The lower end of the barrel of part *B* is turned eccentric with relation to the hole that fits over the stud. A flat bar at *D* is fastened to the base of the compound rest by the screw *E*, and at the other end it has a transverse slot enclosing the eccentric barrel. The width of the slot (in a direction parallel to the cross-slide) is just equal to the diameter of the eccentric, but its length (crosswise of the bar) is a little more than the "throw" of the eccentric, so that clearance is provided in extreme positions.

A small removable pin *F* attaches a connecting rod *G* to the slotted lever in any one of the positions represented by the holes in the latter. The other end of the connecting rod is attached by a swiveling joint to a bracket bolted to the headstock of the lathe. The connection at this swivel joint is such that the effective length of the connecting rod *G* may be increased or lessened at will.

The action of the device is obvious. With a pulley in the lathe, the turning tool is set midway of the face to be crowned and, with the swivel connection at the headstock loosened, the lever of part *B* is swung to extend straight back in parallel to the cross-slide—when the eccentric is in mid-position and the cross-slide at its extreme outward point.

The pin *F* is then put through the hole in the slotted lever that will give the desired amplitude of swing corresponding to the width of the pulley and amount of crown. The farther out the pin is placed, the wider may be the pulley to be crowned, or the less will be the amount of crown on a narrower pulley. The pin, of course, passes through the end of connecting rod *G* in whatever position it is placed.

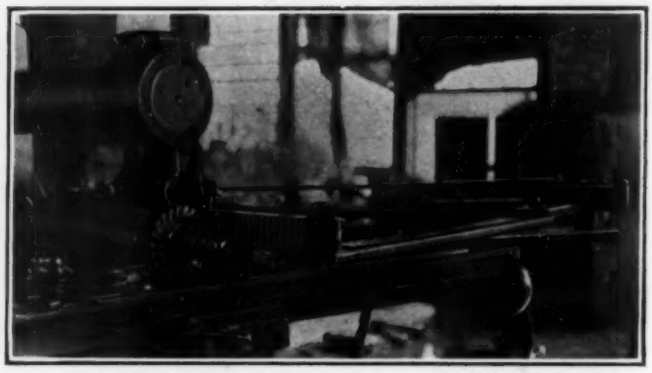
The swivelling connection at the headstock is now tightened and the operator proceeds to crown the pulley exactly as he would turn a straight-faced pulley if the attachment were not there, manipulating the turning tool for diameter by the compound rest and handling the carriage in the regular manner.

There are but two things to remember, or, rather, two phases of the same thing. In changing pulleys the operator should make sure that all pulleys go to the same place with reference to the faceplate—a point that will be taken care of automatically if the hubs are faced. If he takes out the turning tool to resharpen it, he should put it back in its original position. Failing in either, he may loosen the swivel connection, reset the lever *C*, tighten the connection and go ahead—a matter of ten seconds.

Milling Slots in Reverse-Lever Quadrants

BY HOWARD CAMPBELL

The operation of milling slots in reverse-lever quadrants as done in the Parsons, Kan., shops of the M. K. & T. Railway is shown in the illustration herewith. The quadrant is mounted on a radius attachment in which the rods are proportioned so that the slots will be cut on the desired radius. The slots are spaced ½ in. apart, which is done as follows: a tooth is cut, the work being fed vertically against the cutter, then the table is lowered again until as much of the cutter as possible is



Milling teeth in reverse-lever quadrant

engaged in the slot just cut. The clamp that holds the work is loosened and the table is fed by hand toward the machine column a distance of ½ in., the cutter serving to hold the work stationary while the table is being moved. The work is now clamped again, lowered to clear the cutter and the table is moved back ½ in., bringing the work with it. Another cut is now taken and the operation is repeated until all the slots have been cut. A sheet-steel gage with four teeth, of the same design as the quadrant latch, is used to check the work.

The cutter runs at a speed of 50 ft. per min. and feeds 0.012 in. per rev. The 61 slots are cut, including setting-up time, in 5 hours.

Making Accurate Radius-Turning Tools Cheaply

By F. J. Kennedy

In the making of small forming rolls, we experienced difficulty in cutting grooves and fillets to radii within the accuracy required, until we adopted the following expedient for making the tools:

In Fig. 1 may be seen a piece of ⅜-in. sq. annealed high-speed steel held in the chuck of a lathe in such

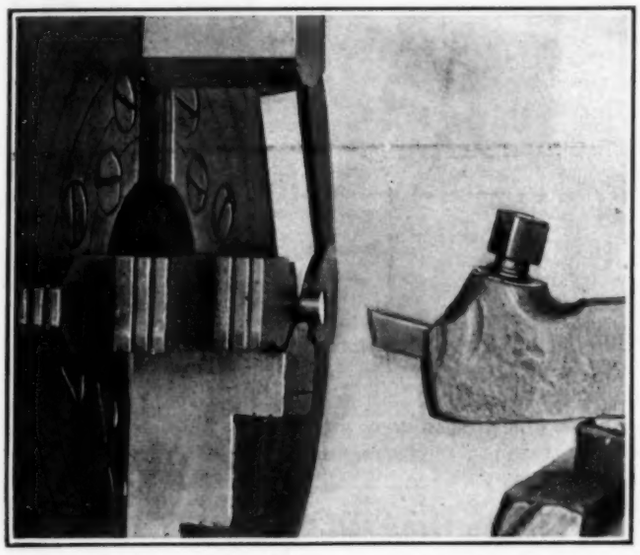


Fig. 1—Turning a small radius tool

manner that the exposed face is tilted at an angle of 6 deg. and a sufficient amount of stock at one end is projecting beyond the jaws of the chuck to enable the operator to turn the small boss upon the face.

A close approximation to exactness of contour is

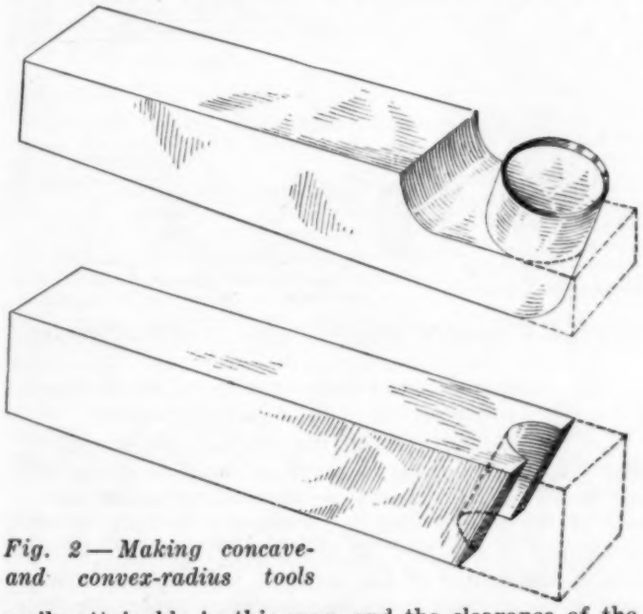


Fig. 2—Making concave- and convex-radius tools

easily attainable in this way, and the clearance of the tool is accurately established by the degree to which the stock is tilted in the chuck. It remains only to grind or file away the projecting corners of the material, which by reason of the chuck jaws the turning tool is unable to reach, until this portion of the end of the stock matches the contour of the turned boss.

To make tools of the reverse radius it is necessary only to set the stock in the lathe chuck in the same manner and to drill and ream a hole of the required size through it; after which the end of the stock is ground or cut away down to the diameter of the hole. Fig. 2 indicates where the stock is to be ground away.

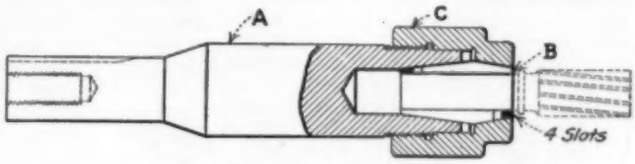
The advantages of this method of making tools of small radius should be apparent. Sizes are obtainable without the use of elaborate gages or templets; clearances are correct and uniform; and by confining the grinding for resharpening to the top of the tool there need be no change in its contour during its useful life.

An Extension Holder for End Mills

By S. A. White

Having occasion to use a small vertical milling machine on a special job, I found that I was unable to reach the surface to be milled with any of the collets of the regular equipment because of the interference of a projecting boss on the work. I accordingly made an extension collet, or holder to take the regular end-mill shanks.

The shank *A* of the extension is made to go in the spindle of the milling machine in place of the regular collets, where it is held by the regular draw-bolt. The



Extension collet for end mill

outer end of the shank is bored out to take a special collet of the style shown in the sketch at *B*, which is slotted in four places in the usual manner and which is held to its seat by the collar *C*, threaded to the shank of the extension.

The circmference of the collar is knurled, in order to give it a good hand grip and make it convenient to change cutters.

Position of Rests in Centerless Grinding

By Charles F. Henry

There is considerable discussion as to the possibilities of centerless grinding. Some automobile manufacturers contend that to get truly round work the piece must be round before it goes to the centerless

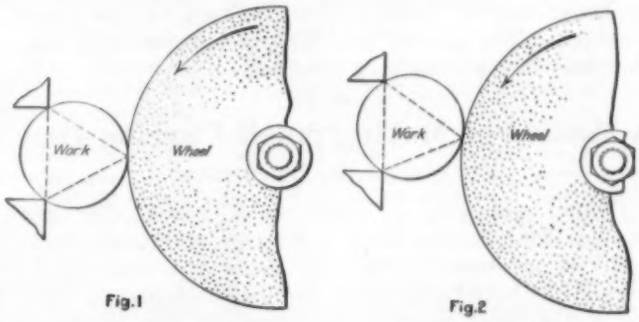


Fig. 1—Contact points of work-rest equidistant from the wheel. Fig. 2—Contact points of work-rest unequal distances from the wheel

grinder. For this reason they rough-grind piston pins on centers, and finish them on a centerless grinder.

One concern, which does centerless grinding to a large extent, has found that much depends on the work-rest opposite the grinding wheel. Its experience has been that the two lines of contact should be "off-center" to secure the best results. With the contacts at an equal distance from the wheel surface, as in Fig. 1, the work will not be round unless it was round before grinding. But with the rests spaced as shown in Fig. 2, inequalities in the work can be corrected, making the finished product round. Use is made of both the single and double wheel types of machine but the second wheel is considered as a support.

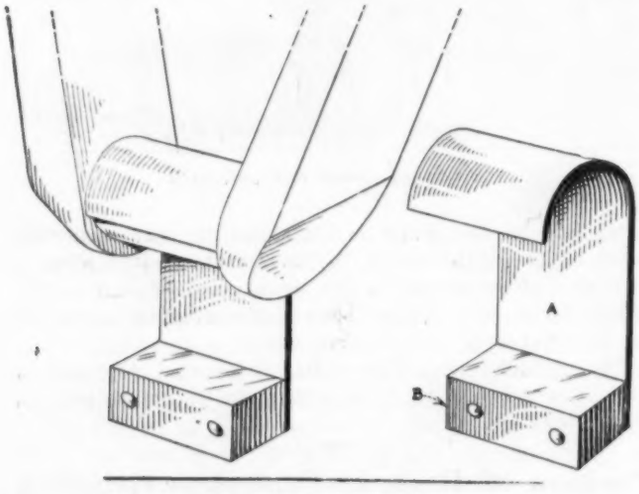
It would be interesting to know if others have had a similar experience.

A Crankpin Guard

BY FRANK C. HUDSON

More and more care is being taken in automobile engine shops to prevent even the slightest injury to crankshaft pins. For it has been found that even a slight surface abrasion may shorten the useful life of a motor.

To guard crankpins during assembly, one shop uses the guards shown herewith. The guards consist of



Guard for crankpin

strips of brass or aluminum as at *A*, with weights *B*, riveted to the lower ends. Plenty of these guards are provided, and when the assembler puts a crankshaft on his stand or bench to put the connecting rods in place, he hangs one of these guards on each of the other bearings. The guards are easily made, quickly handled, and have proved very effective.

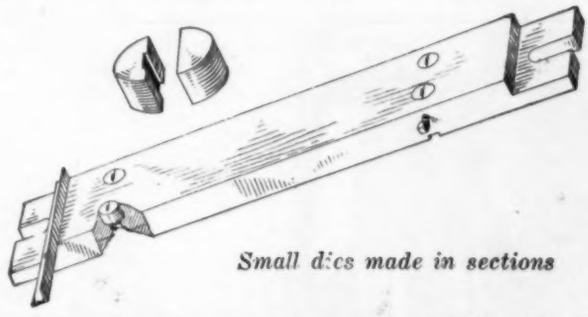
A Method of Making Small Piercing Dies

BY WALTER E. GUNNERSON

Having occasion to make some small dies and punches for piercing slots in 20-gage aluminum stock, and the openings in the dies being too small to be worked out satisfactorily by the usual method of drilling and filing, I adopted the expedient here described for doing the work.

The openings were rectangular in shape and were $\frac{1}{32} \times \frac{1}{8}$ in. in dimensions. Four holes were carefully laid off on a cast-iron die holder, drilled and counterbored to $\frac{3}{4}$ in. in diameter. Eight $\frac{3}{4}$-in. plugs of tool steel were next made to fit the counterbored holes, and one-half of each plug was then milled away, so that when two of the semi-circular pieces were matched together they could be forced into the counterbored hole as one plug.

In four of the half-plugs a groove was milled, $\frac{1}{8}$ in. wide by $\frac{1}{32}$ in. deep; the size of the required opening. When one such half-plug was forced with its mate into one of the counterbored holes in the die-holder, the



Small dies made in sections

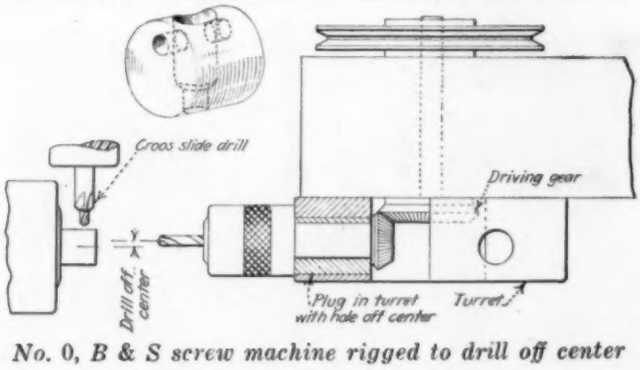
required rectangular opening was completed by the flat side of the mating plug, as shown in the illustration.

By making the dies in this way the work was done more accurately and in much less time than would have been possible by ordinary methods. The open slot made it quite easy to file the necessary draft in the die.

Drilling a Hole Off-Center in a B & S Automatic

BY FRED W. MANSEY

The accompanying sketch shows a piece which it was necessary to produce very cheaply and in large quantities. The main difficulty was to drill the small hole lengthwise of the piece at such a distance from the



No. 0, B & S screw machine rigged to drill off center

center. The work was finally done in a No. O, Brown & Sharpe screw machine in the following manner:

The turret was taken off the machine and one of the turret holes bored out as large as could be done with safety. This hole was then carefully plugged and a hole of the proper size to receive the drilling spindle was bored in the plug at the desired distance to one side of the center of the original hole. Some adjustment of the driving gears was necessary to accommodate them to the new center line, but this was easily accomplished at small expense.

With this arrangement it is possible to drill at any distance from center within the limits of the plugged hole in the turret, by making a new bushing with the desired amount of eccentricity.

Technical Abstracts

Will Pensions Break the Business?

Adoption of pension plans by industrial establishments makes steady progress in spite of actuarial prophecies of dire consequences in the future. At the same time, thinking managers of business have serious misgivings on the whole subject. Well supported arguments seem to indicate that pension costs in the average corporation, both absolutely and in terms of percentage of payroll, will continue to mount for at least forty or fifty years after the pension is inaugurated. The ultimate cost, it is asserted, will range all the way from three per cent to ten per cent of the payroll and in exceptional cases may even be much greater. Industrial managers are being warned, moreover, that the large company which adopts a pension assumes an initial "accrued liability" which to be safely carried demands a reserve amounting perhaps to many millions. Some corporations are refraining from the adoption of pensions and are seeking substitutes in the shape of savings plans and other incentives to self support in old age. Others are revising their pension finance systems with a view to the adoption of strict pay-as-you-go policies. Yet others, and this attitude is more typical, are going ahead, paying their pension costs as they arise and hoping for the best.—*American Management Review*, August, 1924, p. 4.

Industrial Psychology

This paper by Dr. H. S. Person, managing director of the Taylor Society, New York, opens up a new consideration for managerial executives. There has been a sudden development of interests in phychology and some of the reasons are that during the war consideration was given to the nature of behavior as part of the problem of securing united effort. There was practical application made by psychologists on a large scale, of intelligence and trade tests toward the classification of individuals in the army and great publicity was given to these psychological investigations. Literature of industrial psychology has increased greatly during the past two or three years and Dr. Person gives a list of fourteen books, all bearing on the subject. Among the books mentioned is one by James, "Talks to Teachers," specifically recommended, as is also that by Lillian M. Gilbreth on "Psychology of Management."

All are in agreement that psychology is the science of the nature and causes of conduct and of its control, but there is need for co-operation in its further development, and in the development of a dependable technique.

Facilities must be offered for psychologists for research in the industrial field. So far they have been restricted to laboratories, schools and psychopathic institutions. The actual results of research in the field of industrial psychology have been relatively meager, the only outstanding points being some limited research in the field of selling and of advertising, and some with respect to the determination of special aptitudes for special operations, and, of course, those dealing with the construction, verification and valuation of general intelligence.

Most of the achievements in the field pertain to very special aspects of management, such as the selection of workers, and they have not yet touched on the real management problem of inspiring interest, understanding, initiative, effort, precision and personal effectiveness in co-operative activity. There must be a distinction between the contribution of tools used in management and the contribution of principles to assist in the way of management. Dr. Person notes the point that where scientific management with its standardization, planning, scheduling, progress records and other mechanism has been introduced, people generally show more interest, originality, initiative and intellectual self-expression than they had done before the development of the standards, and more than is characteristic of other people engaged in similar work.

The problem of industrial relations becomes involved in the problem of human progress, therefore the opportunity offered to industry to co-operate with psychologists in further research is one which is of far-reaching importance.—*Taylor Society Bulletin*, Aug., 1924, p. 163.

The Profitable Side of the Lathe

B. M. Ikert discusses the versatility of the lathe. This is a basic unit of every repair shop and a shop equipped with it is independent to a large degree. From all that can be gathered in the field of service from lathe makers, the lathe with a 16-in. swing and 8-ft. bed is the most popular and useful size. In a majority of cases a standard change gear lathe costing about $75 less than a quick change gear lathe is quite satisfactory, but there should be added such equipment as milling and key-way cutting attachment, a milling arbor, cutters, taper turning attachment, grinding attachment, drill chuck, boring tool, threading tool, independent chuck, lathe dogs and Armstrong patent holder and tools. These of course in addition to the regular lathe tools and tools for handling wood. —*Motor Age*, Aug. 14, 1924, p. 18.

Finishing Metal Furniture

The Simmons Co. has been making metal beds for over fifty years, but its new type of finish on steel beds was introduced some eight years ago. Except in instances where a special design is required, the Simmons metal furniture receives four coatings: a prime, glaze, and two coats of high-bake varnish. Enamel finish is used only on volume beds. This finish is applied by spraying, the exceptions being spring beds which are dipped and the volume beds which are flowed. This flowing is done in a rather unique way. Two horizontal waves spaced about a foot apart, and of sufficient width to accommodate the widest headboard, are located at the top of a tank. The tank is deep enough so that the highest headboard can be lowered until completely submerged. These waves impinge against each other, thereby flowing over the beds as they are automatically lowered into the tank from an overhead conveyor. The excess enamel is withdrawn from the bottom of the tank through a strainer.

The oven capacity of the plant at Kenosha is such that if placed end to end they would extend over a distance of five miles. Until a year ago they were all operated by steam with the exception of one, which was electric. The steam ovens are of the box type in which indirect heat does the work. A current of air is passed over a set of steam coils, and the hot air is introduced through ducts at the top of the ovens and drawn out at floor level. Complete re-circulation of air is effected about once every minute. The electric ovens operate on a similar principle. During this last year, however, after considerable research, it was decided to install indirect heated oil-fired ovens by the Drying Systems, Inc., Chicago. These ovens are described more fully in this article.—*Fuels and Furnaces*, August, 1924, p. 773.

Setting Machine Tools for Short Jobs

Some examples are given of economic handling of work requiring lathe setup, and savings effected by providing the operator with sketches and complete data beforehand. It is just as necessary to plan carefully for these odd jobs as it is for long run production stuff. One example that is given is that of a bronze bracket fitting of which six only are required. This requires six operations and each one of the lathe operations is described. A set-up sheet is shown as to how this job should be done. Mr. Dowd emphasizes the value of the set-up sheet in saving time.—*The Iron Age*, July 10, p. 74.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Shading Prices Destroys Confidence

THOSE who have reached the half-century mark can well remember when the buying of clothing was a battle of wits and bluff between the merchant and his customer. The man or woman who could bargain and haggle over prices bought clothing for the family at considerably below the asking price. And the person who was not possessed of a combative nature usually paid more than his belligerent neighbor.

To A. T. Stewart is given the credit for abandoning this system and establishing the "one price to all" policy. He evidently discovered that haggling about prices wasted the time of both salesman and customer. It also created resentment and ill-will when a customer discovered that his neighbor had secured a lower price on a similar article. Stewart made friends by his one price system and today every reputable store is strictly one price to all.

It is, therefore, rather disquieting to find that some builders of machinery are resorting to the practice of the clothing dealers of forty years ago and "shading" the prices given in their lists in the hope of securing business. It does not take a professor of ethics to know that such a policy is not only contrary to modern business methods but that it cannot pay in the long run. The customer who receives a "shaded" price is at once suspicious of the seller and cannot help wondering how much more the prices were cut to his competitor.

Unless a price list means what it says, or every customer receives the same discount, it is misleading and fraudulent. When a man puts in a bid and offers to shade it if necessary, he advertises the fact that he is not playing the game openly and above board. And, while he may get an occasional order in this way, he is flirting with business disaster and courting the sheriff's attention.

Confidence is the foundation of modern business. The shading of prices weakens the underpinning by giving suspicion and distrust a chance to enter the mind of the buyer. If the seller's price list doesn't mean what it says, just what does it mean? How much will it be shaded if he delays buying? Will his competitor buy for less money if he haggles more and delays longer?

Offers to shade prices are more apt to delay orders than to hurry them. The buyer loses faith in the seller and in business generally, and hesitates about buying at all. Shaded prices are an invitation to hold orders until prices are shaded still more and in the meantime business revival waits until confidence is restored.

How any builder of machinery with a real knowledge of costs can see his way clear to reducing prices is not clear. But if he feels that the lower prices will stimulate business, let him make his cuts openly instead of shading what is supposed to be his price list. Unless every buyer can purchase at the same price under the same conditions, the business is not honestly conducted and comes under the head of unfair competition.

There is as yet no law which makes a lying price list a misdemeanor. But business ethics is likely to put it under the ban and make it illegal. All recognize its unfairness and it will surely be held as evidence of unfairness in the courts of the future.

Shading prices is a "shady" business and works to the detriment of all. Haggling adds to the expense of selling and increases the cost of doing business.

Make prices right and stick to them.

What Progressive Managers Are Doing

IT IS refreshing to meet managers of machine building concerns who are taking advantage of the present opportunity to improve their shop conditions and to strengthen their position in the machinery field. Instead of shutting up the plant and sitting with idle hands bemoaning the lack of business, they are rearranging their shops to secure more economical supervision, less handling of material, and even putting in newer and better equipment. They are also designing and building improved machinery.

Unfortunately, perhaps, every manager has to be something of a speculator. He must to some extent at least anticipate the future and buy pig iron and other material to cover future needs. He must also carefully consider whether to break up his organization by sharp curtailment, or carry his key men and utilize them in improving his machinery and methods.

We have recently had the pleasure of meeting several managers who have taken the broad viewpoint. They are buying pig iron and steel. They realize that increased business can come only when all hands begin to buy.

These managers are also maintaining their organization to the best of their ability, working part time rather than laying good men off entirely. They are utilizing their present lull to have machine designs perfected and entirely new machines designed and tested and are investing money with the knowledge that only in this way will their position in the industry be assured in the days to come.

These are the times that test the courage and real ability of management. It requires no courage to spend money when the books are full of orders and customers are clamoring for machines. But those who are content to "sit tight" and wait for the other fellow to start things are very apt to find that he has started them so effectually that the "sit-tighters" will have trouble in catching up.

Business is coming back for those who are ready for it and are going after it right. But those who are caught napping are very likely to see only the tail light around the corner as the order train draws up at the other fellow's door.

Draftsman vs. Designer

THE draftsman is a man who knows how to draw. The designer is a man who knows what to draw.

The draftsman must know how to use a pencil. If he wants to become a designer he must learn how to use an eraser.

Shop Equipment News

Pratt & Whitney 6-In. Model B Vertical Shaper

The Pratt & Whitney Co., Hartford, Conn., is now marketing an improved 6-in. model of its vertical shaper, which incorporates improvements and refinements evolved during the time that the company has manufactured this type of shapers. The machine has been designated the model B, and the basic principle of the vertical design remains unchanged.

As illustrated in Fig. 1, the machine consists of a solid bed on which

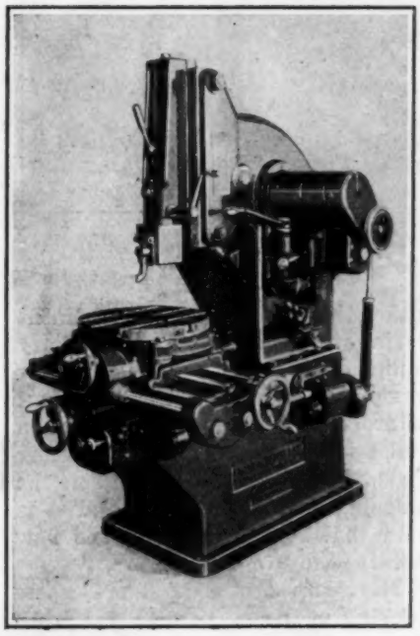


Fig. 1—Pratt & Whitney 6-in. Model B Vertical Shaper

are mounted a rotary work table and a column that supports the vertical ram and contains the ram actuating mechanism. This type of construction brings all cutting pressures directly on the table and the bed beneath, eliminating the spring in the table and holding the work with the necessary rigidity. The vertical construction also permits easy work handling and the angular adjustment of the ram.

For driving the machine either a built-in motor drive or a single belt pulley for driving from a lineshaft can be furnished. With either arrangement the main driving pulley rotates at 450 r.p.m. For motor driving a 3-hp. motor is mounted inside the bed, its position being low enough to eliminate vibration. The motor is suitably enclosed so that the entrance of chips and dirt is not easy, but at the same time it is suitably ventilated and accessible for adjustment. The motor drivies the machine through a belt for which cast-iron guards are provided.

A friction clutch is embodied in the main drive pulley of the mach-

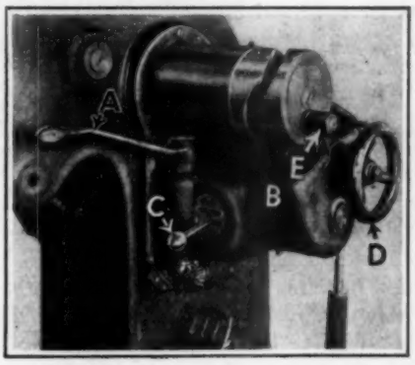


Fig. 2—Speed controls for Pratt & Whitney shaper

ine and is controlled by a lever located at the right of the ram and shown at *A*, Fig 2. This lever controls the operation of the machine at all times and has three positions; a working position, a neutral position and a third position in which a brake is applied to stop the machine quickly.

The power is taken into a gear box *B* on the right side of the column, in which a selective gear drive for the ram is enclosed. Four speeds and a neutral position are provided and are controlled by a shift lever *C* working in an H-slot. The construction of the gear box is similar to the construction of an automobile transmission. Alloy-steel Maag gears are used and the mechanism is lubricated by means of a splash system.

From the gear box power is delivered to the ram through a large slotted eccentric and follower block, this mechanism producing the slow power stroke and the quick return motion. The ram is counterbalanced and the mechanism is enclosed. The ram and its slide form a separaate unit on the front of the column. The slide is hinged at the top and has a screw adjustment at the bottom which permits the unit to be swung to any angle up to 5 degrees and securely locked in position. This construction allows the machining of the angular sides of dies conveniently. An angular scale for setting the ram is provided and the ram can be returned to its vertical position at any time without further adjustment.

The ram is suitably gibbed and provided with necessary adjustments for wear. A handwheel *D* attached to the gear box can be used to move

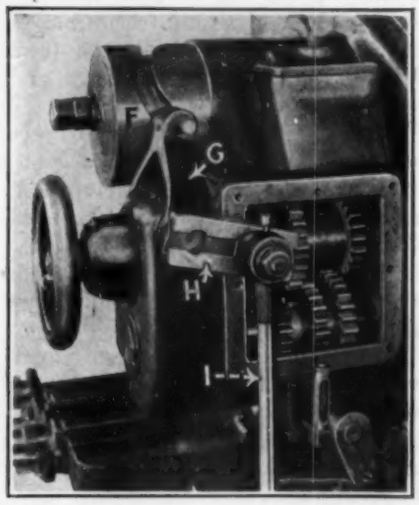


Fig. 3—Pratt & Whitney shaper feed mechanism

the ram throughout its entire stroke for positioning at the start of a cut. The vertical position of the ram on the slide is obtained by a crank that operates a vertical screw and a positioning nut through bevel gears. A binder handle locks the ram in position.

The length of the ram stroke can

be varied from zero to 6½ in. by a locknut adjustment *E* on the end of the feed cam. The four speeds of the gear box produce ram speeds of 33, 49, 76 and 116 strokes per minute. The tool post is carried in a clapper mounted so that the thrust of the tool forces it against the head. The tool post binder screw has been eliminated, the tool being held by drawing the tool post against it from the back. This feature permits the tool post to pass over the work without interference, and in no case does it project beyond the cutting edge of the tool. The tool head may be rotated through 360 degrees and clamped securely in position.

Power feed for the entire machine is obtained from the feed cam *F*, Fig. 3, on the upper right-hand side of the column. This cam is driven by an extension of a shaft from the gear box, so that it is always in correct relation to the ram. The cam follower *G* actuates a crank *H*, so that the feed is supplied by a rocker motion at the end of each stroke. The rod *I* connecting the crank with the feed gear box is adjustable on the crank for varying the amount of feed. This rod consists of a sleeve containing a plunger and a spring that will transmit sufficient power for regular working conditions but will compress sufficiently to prevent feeding should the work or tool become jammed through careless handling. As shown in Fig.1, the feed driving mechanism is entirely enclosed by suitable covers.

The feed gear box is located directly beneath the cam, the rod from the cam-operated crank driving a notched wheel through a double pawl. The gearing provides a forward, neutral and reverse feed drive, and is controlled by a push-and-pull knob at the front of the bed.

The carriage is mounted on transverse ways on the bed and the rotary table is arranged to slide on longitudinal ways on the carriage. A total transverse travel of 14 in., and a longitudinal travel of 25 in., are available. Handwheels and micrometer dials are provided for traversing by hand, and binders are fitted for locking both sides in position when desired.

The rotary table is 19¾ in. in diameter and is provided with 12 indexing notches. This means of rapid indexing is valuable when surfaces are to be machined in a definite angular relation to each other. Circular holes and surfaces can be machined by using the rotating device.

Power feeds are supplied for both the longitudinal and transverse slides and are controlled by slip gears. Power feed for the rotary table can be furnished if desired. The range of feeds available is from 0.0027 to 0.0243 in. per stroke for the transverse and longitudinal table travel, and from 0.009 to 0.085 in. per stroke on a 10-in. radius for the rotary power feed.

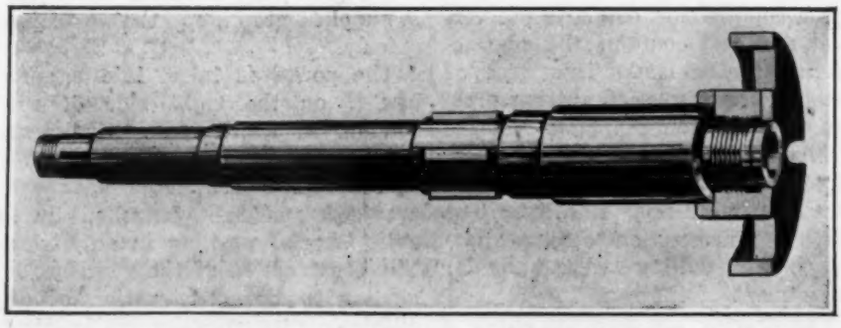
The distance from the table top to the under side of the ram bearing is 10¼ in. and the maximum distance from the table to the ram itself is 15 in. The floor space occupied by the machine is 53 x 68¼ in. and the machine weighs about 4,550 lb. with the regular equipment.

Hardened Spindle for Lehmann Geared-Head Lathes

The Lehmann Machine Co., Chouteau and Grand Aves., St. Louis, Mo., has recently developed an improved hardened spindle for use on its geared-head lathes. This spindle is shown in the accompanying illustration.

The part is made of alloy steel. It is properly ground to secure a low co-efficient of friction and is designed to run in hard bronze bearings without danger of grooving. It is driven through four integral keys.

The spindle nose provides a hardened bearing for chuck or faceplate on both sides of the thread and a shoulder for the maintenance of correct position. The threads of the plates are flattened a little on the inside of the plates and are a free fit over the outer nose. This permits them to be slipped over the nose, piloting them onto the threads, and the engagement of several threads before the mating portions are brought into contact permits close fits on the nose bearings.



Hardened Spindle for Lehmann Geared-Head Lathes

"Gusher" Motor-Driven Lubricant Pumps

The Ruthman Machinery Co., Cincinnati, Ohio, has recently placed on the market three motor-driven models of its "Gusher" lubricant pump. These models differ only in capacity, model S-L delivering 15 gal., model H-L 30 gal., and model F-L 80 gal. of lubricant per minute.

The pumps are constructed so they can be attached to a machine by four machine screws. This

"Gusher" Motor-Driven Lubricant Pump

makes them adaptable for permanent parts of machines or as auxiliary equipment for use when the regular pump equipment on a machine is out of order. The rotating parts run in ball bearings. A simple regulating valve is provided to control the amount of fluid delivered, and it is said that totally checking the flow does not injure the pump.

No gears are used, there is no packing in the mechanism and priming is unnecessary. The machine can be quickly disassembled for cleaning. The motor is direct-connected to the pump.

Besly Semi-Automatic Grinder for Coil Springs

A recent addition to the line of grinding equipment manufactured by Charles H. Besly & Co., 118 N. Clinton St., Chicago, Ill., is a belt-driven, dry-grinding machine, equipped with a semi-automatic feeding mechanism for grinding the ends of coil springs. The springs, for which the feeding device shown

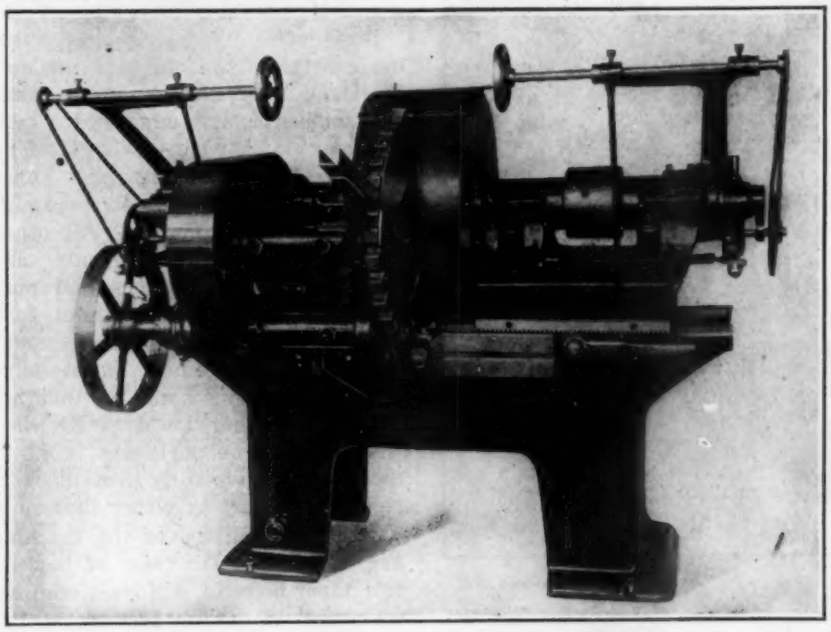


Fig. 1—Besly Semi-Automatic Grinder for Coil Springs

in the accompanying illustrations was built, are 1¼ in. in diameter and 1⅞ in. long, the diameter of the wire in the coil being ⅛ in. About one-half of a coil is removed at each end, and it is said that the springs can be ground at the rate of 3,000 per hour.

The rotary feeding device is illustrated in Fig. 2. The springs are fed into the chute by the operator and pass into suitable spaces in the periphery of the feeding wheel. The feeding wheel carries the springs between the two ring-type grinding wheels, the springs being held in the feeding wheel bushings by means of suitable guide plates. The grinding wheels are not separated to allow the work to enter but are locked in the required position to produce springs of the proper length, the only adjustment necessary being for wear. The springs are compressed as they pass between the guides, and the ends of the springs bear against the grinding wheels as soon as they are released from the guides.

The bed of the machine is designed for dry grinding, having a pocket with an outlet at the rear for attaching an exhaust pipe to remove the grinding dust. Two ways are machined on the top of the bed, and the spindle heads slide upon these ways. These heads are secured in position by bolts attached to anchor castings under the bed. The position of the heads on the bed is adjusted by means of a rack and pinion arrangement. The spindles are mounted in phosphor-bronze ring-oiling bearings.

The spindle drive pulleys are 8½ in. in diameter by 6¼ in long. Each

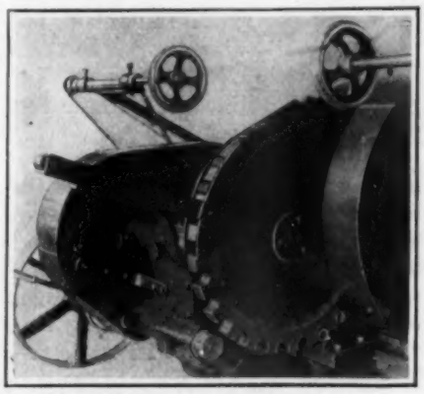


Fig. 2—Feeding device for Besly coil spring grinder

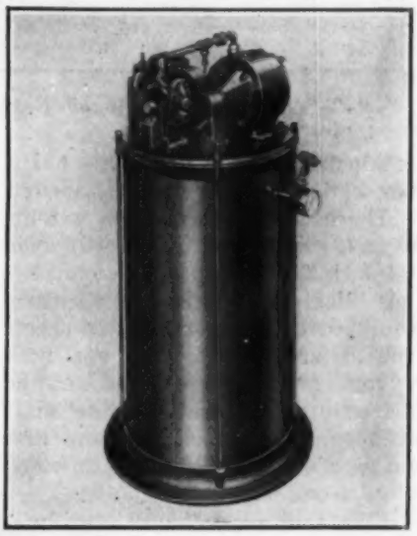
spindle has a micrometer adjustment controlled from the operating side of the machine by handwheels, shafts and sprockets. The outer end bearings for the spindles have rack teeth that mesh with the pinions controlling the endwise movement of the spindles.

Exhaust hood castings are secured to the wheel heads and are always in proper relation to the grinding wheels. The feeding device is driven from a countershaft, a friction clutch pulley being attached to the end of the feed drive shaft. A suitable reduction gearing arrangement is provided between the drive shaft and the feeding wheel shaft.

The grinding wheels are 24 in. in diameter and are held in pressed steel chucks that are equipped with setting-out plates and steel clamping rings and attached to the wheel collars by hardened capscrews.

Dunning Two-Cylinder Junior Automatic Compressor

The Dunning Compressor Co., Holmesburg, Philadelphia, Pa., is now marketing a small automatic air compressor, known as its Junior model. The motor and the pump are



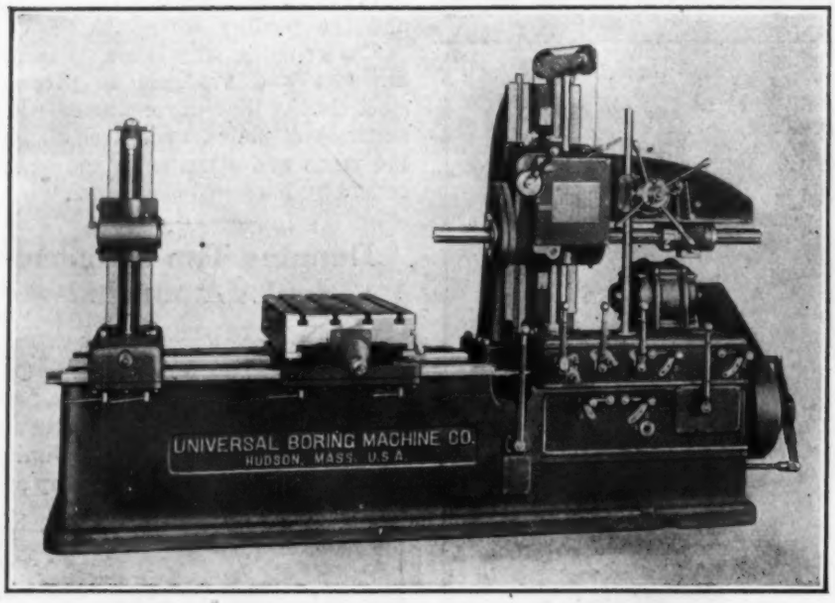
Dunning Two-Cylinder Junior Automatic Compressor

mounted on the top of a 15-gallon tank as shown in the accompanying illustration, the whole outfit being a self-contained unit.

The two cylinder pump has a 2-in. bore and a 2-in. stroke, being driven by a ½-hp. motor. An automatic stop and start switch is provided together with an automatic unloader. The working pressure is 125 pounds. The motor can be connected to any convenient electrical outlet. The tank is fitted with a suitable safety valve and a pressure gage.

Universal "Tri-Way" Boring Machine with 2½-In. Bar

The Universal Boring Machine Co., Hudson, Mass., has brought out a small size of its "Tri-Way" boring machine, embodying the same principles of construction as the larger machine but with a more limited range, and with added features in the way of ease of control and manipulation. This machine has a bar 2½ instead of 4 in. in diameter.



Universal "Tri-Way" Boring Machine with 2½-In. Bar

The machine is driven by a 5-hp. electric motor mounted directly upon the bed, as shown in the accompanying illustration, and is regularly equipped with motor base, sprockets and driving chain, but not with motor unless ordered. It can be driven directly from the line shaft if desired, in which case the first shaft of the machine is provided with a belt-pulley and clutch.

Like the larger model, this machine is "right-handed", it being the contention of the maker that such construction tends to more convenient manipulation of the various movements. The upright lever nearest the operator's position is the starting lever, and serves to put the driving shafts in motion, but does not start any of the feeding movements unless the remaining levers have been correspondingly adjusted.

Of the three shorter levers adjoining the starting lever the first is called the "selective feed lever". Its function is to determine which of the three movements—vertical, longitudinal, or cross-feed—shall be put in operation. It has four positions: neutral (perpendicular) right, left, or straight out from the machine.

The second, or middle, lever, used in conjunction with the third one, determines the direction of the movement, and also whether it is to be a comparatively slow motion for feeding or a rapid traverse for positioning the parts. It has three positions, neutral, right and left. When thrown to the right it starts the feeding movement of the part determined by the position of the first lever in the direction determined by the position of the third lever. Thrown to the left it engages the rapid traverse of the same part, but in the opposite direction. The third lever is solely for the purpose of reversing the direction of the movements.

The longer lever, nearest the driving end of the machine, controls the movements of the boring bar only. The crank levers on the upper gear box govern the positions of the selective feed gears, giving nine changes of feed in either direction to any part that may be engaged by its respective lever. The range of feeds to the boring bar can be doubled by moving a small lever in the head, making 18 feeds available. The crank levers on the lower gear box give nine changes of rotative speed to the spindle, the range being doubled by means of backgears controlled by the larger lever on the head. The speeds range from 16 to 650 revolutions per minute.

All gears are of steel, and all sliding gears have rounded-end teeth and are heat treated. All speed and feed gears are contained in two separate boxes, each assembled as a unit and capable of being removed from the machine without disassembly when the holding bolts are withdrawn. All gears run partly submerged in oil, and each gear box is provided with a visible oil-level gage.

Position of the bar is always under control of the operator through the large capstan wheel on the head. The smaller capstan engages the feed by means of a positive clutch. The selective gears in the gear boxes cannot be moved without disengaging the driving clutch. All other speed or feed engagements are through friction clutches and may be made at any time without fear of damage. The rapid traverse must be held in engagement by pressure of the operator's hand, so that his attention cannot be directed elsewhere while the parts are in rapid motion. Positive stops prevent overrun of any part in either direction.

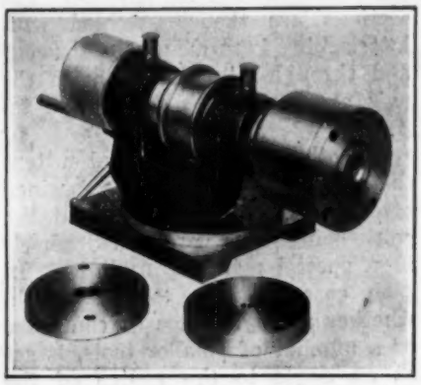
The specifications of the machine are as follows: Diameter of bar, 2½ in.; taper hole No. 4 Morse; endwise movement of bar for feeding, 20 in., increased by resetting to 36 in.; power traverse (for standard length of bed) 24 in.; power cross-feed, 32 in.; power vertical feed, 20 in.; maximum distance from table surface to center of bar, 21½ in.; greatest distance from faceplate to outer support (standard length of bed), 48 inches.

The floor dimensions of the machine with standard bed are 34 x 106 in., to which must be added about 18 in. in length and 24 in. in width for overhang and overrun, respectively. The weight of the machine crated for shipment is approximately 5½ tons. Special beds, table, rotary tables, boring heads and star-feed facing heads are furnished on order.

Walker 4-R Rotary Magnetic Chuck

The accompanying illustration shows the application of the 4-R rotary magnetic chuck, recently brought out by the O. S. Walker Co., Inc., Worcester, Mass., to the spindle of a Rivett No. 103 grinding ma-

chine. This chuck is of the standard two-pole concentric type that requires an auxiliary faceplate to conform to the particular piece of work for which it is to be used. Plates can be furnished for any size or shape of part within the limitations



Walker 4-R Rotary Magnetic Chuck

of the chuck. It is particularly adapted for the grinding of saws, cutters, ball and roller bearing parts, etc., of small diameter.

The contact rings and shoes are located at the rear end of the spindle and are protected from water and dust by an aluminum guard. Because of this location it is necessary to utilize the central hole of the spindle for the passage of the wires that convey the energizing current from the contact rings to the magnets of the chuck, and water cannot, therefore, be delivered through the spindle.

Van Norman No. 10 Duplex Miller

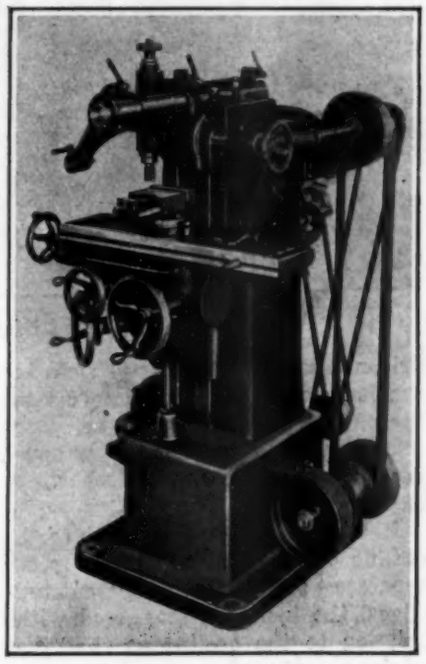
The Van Norman Machine Tool Co., Springfield, Mass., has recently brought out an improved model of its duplex milling machine, designated No. 10. It is constructed along the same general lines as the No. ½ machine but is heavier and more rigid, and changes have been made in the driving mechanism to make the drive more direct and powerful as well as to give the operator better control.

The knee, saddle and table are the same as in the No. ½ machine. The knee has a vertical adjustment of 16 in. upon the face of the column operated by a screw, bevel-gears and a handwheel. The saddle has a cross movement of 6 in. on the knee. The table surface is 30 x 6¾ in. and has an automatic feed of 20 inches. All of the operating screws are fitted with micrometer dials. The table is provided with a rapid traverse, operated by a large handwheel.

Three slots are provided in the table for standard T-head bolts. The machine has six feeds in either direction, controlled through shifting gears running in oil and driven by a belt and a pair of 3-step cones. The gear box is provided with an observation gage to show the level of the oil.

The location of the spindle drive on this machine gives the operator greater freedom in setting-up, inspecting or gaging his work, and a handwheel on the end of the drive shaft enables him to turn the spindle at will or to hold it against turning when tightening or releasing the collets. The spindle is hardened and ground and runs in bearings that are adjustable to compensate for wear.

The main spindle is carried on a cross-sliding ram, as in the other types of Van Norman machines, to



Van Norman No. 10 Duplex Miller

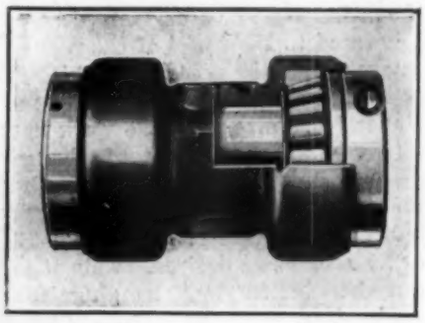
supplement the cross movement of the saddle. This ram has a transverse movement of 6½ in. and can be clamped tightly in any position. A swivelling head is attachable to the face of the ram, capable of adjustment to any position in the vertical plane. Both the horizontal and the adjustable spindles take standard collets, tightened by means of a draw-bar.

The machine is driven by belt, either from a countershaft or from a motor located at the base of the column. The first shaft, opposite to the motor, runs on ball bearings, and the motor belt drives through holes in the base of the column. A 1-hp. motor is required. The machine is furnished either with a motor or a two-speed countershaft, as desired.

The floor space required is 56 x 46 in. The distance from the floor to the center of the horizontal spindle is 48 inches. The weight of the machine is about 1,800 pounds.

Dodge-Timken Roller Hanger Bearing

A lineshaft bearing that embodies Timken tapered roller bearings has recently been placed on the market by the Dodge Manufacturing



Dodge-Timken Roller Hanger Bearing

Corp., Mishawaka, Ind. In the design of this bearing special attention has been paid to securing ruggedness, simplicity, interchangeability and freedom from lubrication troubles.

The complete bearing has only five parts, and consists of two Timken tapered roller bearings mounted on a ground and slotted steel tube and fitted into an accurately machined housing. The ends of the tube are threaded to receive clamping collars, by means of which an accurate adjustment of the bearings on the tube is obtained. This adjustment is made when the bearing is first assembled and need not be altered by the user.

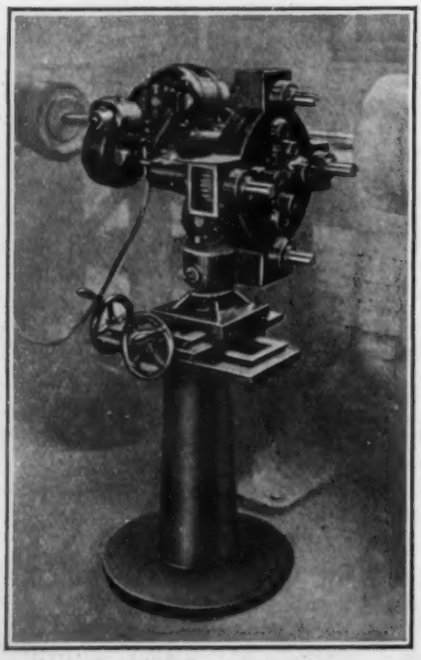
The mounting allows the bearing to function properly under both radial and thrust loads. The steel tube is fastened to the shaft by setting up the screws in the clamping collars. Grease compartments are provided between the housing and the tube and the outer ends of the bearings are protected by metallic grease seals. These seals eliminate friction at this point and prevent the entrance of dust.

Acme Semi-Automatic Work Holder for Polishing and Buffing

A machine for holding work while it is being polished or buffed, and which automatically presents the work to the wheel and revolves it while the operation is in process, has recently been placed on the market by the Acme Manufacturing Co., 1645 Howard St., Detroit, Mich.

The machine is intended for use where standard parts are produced in large quantities, although the machine can be easily and quickly reset. The operating part of the machine consists primarily of a head carrying four spindles, as shown in the illustration. The work is held by expansion chucks that are designed to suit and attached to the spindles. The head indexes automatically at given intervals and, as each piece is presented to the wheel of the polishing machine, the spindle on which it is located starts to revolve and continues to revolve until the work has left the wheel. A set of change gears makes it possible to vary the indexing periods so that the work will be in process either 10, 12, 15 or 20 seconds as desired. This time can be varied by changing the mechanism.

The change gears are controlled by a sliding key which can be quickly set to obtain the interval desired. The head is gibbed to the base so that the proximity of the work to the wheel can be varied, and can be swung on the column at any desired angle to accommodate irregular-shaped work. The machine is self-contained and power is supplied through a ½-hp., a.c. motor which is mounted as shown. The operation of the machine is semi-automatic, an operator only being required to place the pieces on the spindles and remove them after the operation has been performed.



Acme Semi-Automatic Work Holder

O. K. Tool Co. Gear Cutters and Hobs

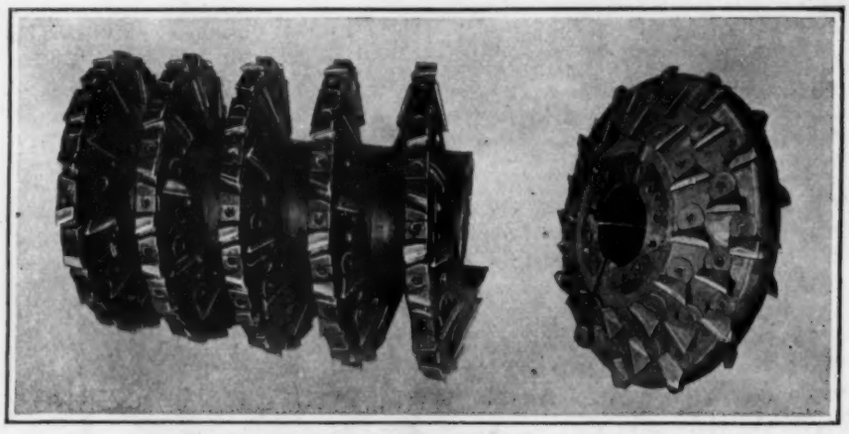
The O. K. Tool Co., Shelton, Conn., has recently developed a line of gear cutters and gear hobs to which the O. K. type of inserted tool is applied. The smaller sizes of both cutters and hobs have a single row of teeth, each tooth being made of flat stock and driven into suitably shaped slots in the body. Each tooth conforms to the outline required to cut the space in the gear. The larger sizes have three, five or six rows of cutting teeth.

In the latter case where each tooth outline of the cutter is made up of separate small tools, or cutting edges, the tools are staggered with relation to the outline so that the various parts of a complete tooth come into action successively, thus distributing the cut more evenly and making the action more continuous than would be the case with a standard form of cutter.

The bodies for the smaller sizes of hobs are cut from bar stock in a lathe, no accuracy of either pitch or tooth contour being necessary as there is at least ⅛-in. clearance all around between the body and the actual cutting edge of the inserted tools. These hobs have a single row of teeth.

The larger sizes of hobs are made in sections, each section being a drop-forging and comprising one full turn of the helix. The holes for the shanks, circular locking-wedges, etc., of the small independent tools are drilled, counterbored and tapped into the periphery and sides of each section while it is held in special fixtures designed for the purpose. The sections are then assembled with interlocking keys on a special arbor and through-bolts parallel with the axis are inserted to hold them together.

In both types of hobs and cutters the actual tooth contour is obtained after the tools are all assembled, the work being done with pencil wheels in a special grinding machine. In each case the face of the tooth, whether a single piece or composed of a number of smaller tools, is set at an angle to the radius of the body so as to give a shearing cut.



O.K. Hob and Disk Cutter for Gears

Any individual tool, whether comprising a complete tooth or only part of a tooth, can be taken out of the body and replaced at low cost without great delay. When the teeth of the center section of a hob, which do the major portion of the work, have become dulled, the hob can be disassembled and any one of the remaining sections reassembled as the center section, this procedure being followed until all five sections have in turn occupied the central position.

When the teeth have been worked down by repeated regrindings until they are no longer serviceable, they can be replaced by new tools and the hob restored to its original condition at a fraction of the cost of a one-piece hob. The hobs are made in 2, 1½, 1¼ and 1 diametral pitch sizes, and the disk cutters in any desired size from 1-in. circular pitch up. Fig. 1 shows a hob of 1 diametral pitch, and Fig. 2 is a disk cutter of 5-in. circular pitch used in cutting very large mill gears.

News of the Week

Machine Tool Men Prepare for New Haven Exhibit at Mason Laboratory

Interesting program has been arranged for four day meeting

Exceptional interest is being shown this year in the New Haven Machine Tool Exhibition that will be held at the Mason Laboratory, New Haven, Conn., Sept. 15, 16, 17 and 18. The exhibition is being held under the auspices of the New Haven section of the American Society of Mechanical Engineers, Yale University and the New Haven Chamber of Commerce and all three of these units are endeavoring to make the event the outstanding engineering success of New England.

Since 1921 there has been held in New Haven each year at the Mason Laboratory an exhibition of machine tools and related equipment. The number of exhibitors and the number of visitors have grown until this annual event is now regarded as one of national significance and importance. The exhibit is the outcome of the "machine tool" meeting of the New Haven section of the A.S.M.E. It was decided that more benefit to a larger number of people could be obtained by some concerted action and hence the annual machine tool exhibit.

This year's program is of particular interest to machine tool builders and engineers in all parts of the country, any many men from the middle west have signified their intention of attending.

THE PROGRAM

On Tuesday, the second day of the meeting, J. A. Smith, chairman of the machine shop practice division of the A.S.M.E. and of the General Electric Co. organization, will preside. Prof. C. A. Beckett, New York, will be the first speaker and his subject will be, "Review of Foreign Progress in Research in Machine Shop Practice." This will be followed by a discussion on the research that is being done in the machine shops of the United States. Wilfred Lewis of Philadelphia and B. H. Blood of Hartford are down on the program for this discussion.

E. F. DuBrul, general manager of the National Machine Tool Builders' Association, Cincinnati, Ohio, will speak on "Forecasting the Demand for Machine Tools."

In the evening Dr. Ira N. Hollis of Worcester, Mass., will preside and a general discussion on education and training for the industries will be held. Mr. Smith of the General Electric Co., Schenectady, will be the leader.

On Wednesday afternoon, D. M. Chason of Elizabethport, N. J., will speak on, "Comparative Methods of Tool Design and Relation to the Quantity Production of Sheet Metal Parts." H. Reynolds of New Britain, Conn., will also be heard on the subject, "Application of Ball Bearings to Machine Tools." Earle Buckingham, Hartford, Conn., will speak on, "Shop Measurements."

Thursday afternoon will also be given over to speakers. E. C. Peck, Cleveland, Ohio, will be the first with the subject, "Selling Standards to Manufacturing Organizations." George T. Trundle, Jr., Cleveland, will speak on, "The Value of Standardization with Examples of Accomplishment," and J. D. Pedersen, Springfield Armory, will speak on, "Manufacturing Design of Ordnance Material."

During the four days there will also be meetings of committees most of them of a national character. The special A.S.M.E. Research Committee on Cutting and Forming Metals, the central committee of the sectional committee on Small Tools and Machine Tool Elements, the working committee on the Standardization of Tee Slots, and many others will meet.

Tours will be made of the various industrial points of interest in New Haven and industrial motion pictures will be shown.

At the present time there have been about 110 exhibitors "signed up" for space and it is expected that there will be more.

Automotive and Railroad Engineers Will Meet

Engineers interested in the design, operation and maintenance of motor-driven railroad coaches, motor buses and motor trucks will gather in New York City on Sept. 18 and 19 for a two day group of meetings to be held under the auspices of the Society of Automotive Engineers and the New York Railroad Club. It is the purpose of these meetings to improve the design of these automotive vehicles so that they may render the most satisfactory service to the public at a minimum of cost.

Many excellent speakers have been secured for the occasion. James Paterson of London, whose firm, Carter-Paterson, Ltd., developed many motor vehicles used by railroads, will be one of the speakers. J. A. Hoffman, vice-president of the Motor Haulage Co., New York City, H. W. Howard, transportation manager of the General Motors Corp., W. L. Bean, mechanical engineer of the New York, New Haven & Hartford, R.R., J. W. Cain, manager of purchases of the American Short Line Railroad Association, F. D. Howell of the Motor Transit Co., Los Angeles, Calif., and many others will speak.

Announce 1925 Exhibit in London

Announcements have been received from London of the forthcoming exhibition to be held Nov. 23 to Dec. 5, 1925, at Olympia, London, W. by the Shipping, Engineering and Machinery Associations of Great Britain. These exhibitions have been held at intervals for the past 20 years and keen interest is usually shown by both the exhibitors and the visitors to the exhibition. F. W. Bridges & Sons, Ltd., Avenue Chambers, 4, Vernon Place, London, W.C.1 have charge of the affair.

Army Manouvres Will Be Held Oct. 3

An interesting program has been arranged for the meeting of the Army Ordnance Association to be held at the Aberdeen Proving Ground, Oct. 3. Infantry, artillery, aviation and other branches of the United States Army will participate in the program and it is expected that the event will be attended by government officials, army officers and industrialists interested in the manufacture of munitions, guns and equipment.

Coast artillery target practice with the use of moving targets towed by airplanes, and practice emplacements will be held in the morning. Following luncheon there will be an inspection of automotive equipment including tanks, tractors, motor carriages, and cross country vehicles. Aircraft and anti-aircraft manouvres followed by field artillery manouvres, small arms exhibits and artillery target practice as well as demonstrations of the motor equipment will complete the day's program.

General J. W. Joyce, head of the technical division of the Ordnance Department of the Army will have charge of the meeting.

Want Letters Written by Frank B. Gilbreth

It will be deeply appreciated by Mrs. Lillian M. Gilbreth if those who possess letters written by her late husband, Frank B. Gilbreth, will lend them to her for possible use in a contemplated biography. Mrs. Gilbreth's address is 68 Eagle Rock Way, Montclair, N. J.

Holland's Problems and Its Efforts in Solving Them

The country's future from an engineering standpoint

E. J. Mehren
Vice-President, the McGraw-Hill Co., Inc.

The innocent by-stander is often hurt. So it was with Holland during the war. So it is now. Holland, in common with the former belligerents, is suffering from the effects of the world's decreased purchasing power.

During the war, it will be recalled, Holland suffered severely. She had no military participation in the conflict, but her economic relations with all the world were disrupted. Her food supply was diminished and strict rationing was necessary. So she shared the war hardships.

After the war her course, economically followed that of the other nations. She had a period of hectic activity, construed, at the time, as an evidence of prosperity. Then came the slump—and Holland has not yet fully recovered.

She suffers, as does England, from fairly large unemployment and from labor inefficiency. But the attitude toward their problems is a hopeful one. The Hollanders say that labor conditions are improving. Wages have come down from the peak, efficiency is increasing, and hours of labor, though fixed at 45 per week by law, have been increased in a few cases. The turn for the better in the labor attitude seems to have come, even though conditions are far from being as good as they were before the war.

Economically, Holland's difficulties, as already suggested, are due to the curtailment of the purchasing power of her former neighbors. Particularly does she suffer from the diminution of the German market. Here again the Hollanders are hopeful, for German trade is picking up a little. The stress due to the introduction of the stabilized rentenmark is beginning to ease and purchasing is being resumed. Nevertheless, trade is far from normal and the country is running at reduced activity.

No Large Projects

Of large projects there are practically none. The only large private enterprise under way in recent years—a blast furnace plant of 500 tons capacity, the first furnaces in Holland—is now completed and in operation.

The building of the great new lock at Ijmuiden has practically been postponed—though some small parts of the work are going on, while the Zuyder Zee draining is progressing at a rate much below what was contemplated.

It is interesting to note, by the way, that the blast furnace was suggested by the war, as a means of insurance for the iron supply of Holland's industry. Coke is secured from Dutch coal, but limestone and ore must be imported.

There is more or less debate about the economies of the plant. Some believe that there is a future for iron production in Holland, but I took it that the prevailing opinion was that while this was the first plant in Holland is was probably also the last. Water-carriage for the limestone and ore is, of course, quite cheap, since the plant is on tide water. Nevertheless, there are European plants with, undoubtedly, more favorable conditions for the assembly of materials. Still, to date, a market for the pig has been found against other competitors, and some of it has been exported.

In regard to the new lock at Ijmuiden—on the canal connecting Amsterdam with the North Sea—it should be noted that the delay, while due to the necessity for curtailing government expenditures, does not now appear serious. Amsterdam's shipping, owing to the general depression, has very considerably declined and the present lock is more than adequate to the needs. Unless the recovery should come with remarkable rapidity, the lock will not be far behind the demand.

Progress in Dikes

At the Zuyder Zee work, the dike between the mainland on the west and the island of Wierigen, is, after four years of work, well along toward completion, but the main dike, from the island to the mainland on the East is not yet in hand. More rapid progress is in abeyance, due to the government policy of reduced expenditure.

Only one considerable new enterprise is under consideration—an extension of the government's assistance to the construction of new roads. The funds for this are to come from a motor-vehicle tax. A report recommending the tax and the road program has been made by a special commission, and it is expected that the legislation will be forthcoming. At present the government aids road work to the extent of 2,000,000 guilders per year. The new taxes are to raise 5,000,000 guilders, and this sum, in addition, will be available for road work, some of it on a co-operative expenditure basis for improvements and some for maintenance. The new work, as well as that now supported by the government, will be under the direection of Herr G. J. Van den Brock, who has been made chief engineer of the government Road Bureau. Herr Van den Broek will be remembered by the waterway engineers of the United States for the extensive canal and lock studies he made there some years ago, in company with Jhr. Van Panhuys.

Even aside from present conditions, Holland has a large economic problem before it. The population is increasing quite rapidly, but the country has no colonies of its own to attract immigrants. Its only considerable colony is the Dutch East Indies, but their tropical climate is impossible for work.

It would be logical under these conditions for the country to become more largely industrial. Thus far it has been mainly agricultural, but development in that direction cannot be extensive. The lands to be made by the Zuyder Zee drainage will offer but a small measure of relief.

Economically, therefore, the problem is pressing and its solution is likely to have very important results for Holland.

Plan Celebration for R. P. I. Centennial

Plans for the celebration in October of the hundredth anniversary of the founding of Rensselaer Polytechnic Institute, Troy, N. Y., are being perfected and it is expected that the largest crowd of engineers ever gathered together at this historic institution will be present.

A program of unusual strength has been arranged with speakers of national and international fame scheduled. In the morning of the first day, Oct. 3, Herbert Hoover, Gov. Alfred E. Smith, Harry E. Clinton, Mayor of Troy, Frank Pierrepont Graves, president of the University of the State of New York, Sir Charles Langbridge Morgan, president of the Institute of Civil Engineers of Great Britain, Henri Abraham, president of the Society of Electrical Engineers of France, Luigi Luiggi, president of the Society of Civil Engineers of Italy, Roberto Gayol, honorary president of the Society of Engineers of Mexico, and Arthur Surveyer, president of the Engineering Institute of Canada, will speak. In the afternoon of the same day tablets will be unveiled on the site of the old main building, which was destroyed by fire in 1904. Hon. Seymour van Santvoord of Troy and Mrs. James Carroll Frazer of Washington, a lineal descendant of Stephen Van Rensselaer, founder of the Institute, will make addresses.

Will Unveil Tablets

Another tablet will be unveiled in the Carnegie Building in memory of S. Wells Williams, a graduate in 1832, who was the first professor of Chinese and Oriental literature in Yale University. Dr. S. K. Alfred Sze, Chinese Minister to the United States, will be the speaker on this occasion.

In the evening a dinner will be held in the State Armory. At this time Livingston Farrand, President of Cornell University, and Joseph H. Odell of the Service Citizens of Delaware, will speak.

At the morning session of the second day President Angell of Yale University, President Birge of the University of Wisconsin, President Stratton of the Massachusetts Institute of Technology, President Grunsky of the American Society of Civil Engineers, President Low of the American Society of Mechanical Engineers, President Kelly of the American Institute of Mining and Metallurgical Engineers, President Osgood of the American Institute of Electrical Engineers, and President Michelson of the National Academy of Sciences, will speak. In the afternoon a reception will be given by President and Mrs. Ricketts of R.P.I.

Big Gains Shown in Labor's Wages

Startling figures are given in a study of labor wages in the past ten years from July, 1914 to July, 1924 by the National Industrial Conference Board. The board reports that in twenty-three leading manufacturing industries covering, on the average, seven hundred thousand employees, wages show an advance of 127.3 per cent, and taking the relation of the changes in earnings to the change in the cost of living from the common base of July, 1914, the figures show that the wage earner in these industries is 27 per cent better off today than he was in July, 1914.

The drop in the cost of living from the high peak of 1920 has been considerably greater in proportion than the drop in wages from the same high peak. Consequently, the purchasing power of the dollar is greater than it was.

Among the hourly wage increases in some of the manufacturing industries may be noted—122 per cent in the automobile trade; 141 per cent in iron and steel; 158 per cent in rubber; 125 per cent in boot and shoe; 166 per cent in Northern cotton mills.

Industries other than manufacturing show similar increases over the same period—anthracite mining 191 per cent; Class I Railroads 135 per cent; building 108 per cent without bonuses, and agriculture 89 per cent. With the exception of building and mining industries, all wages are below the high peak of 1920.

Less striking but still of considerable significance are the changes in employment and hours of work. Employment in identical manufacturing plants throughout the period advanced 12 per cent between July, 1914 and June, 1924. This is a remarkable indication of expansion when it is remembered that employment in June of this year was at a low ebb, being 25 per cent lower than in June, 1920.

The average work week has dropped over five hours during this ten-year period. The average nominal or full-time work week in July, 1914, was fifty-five hours, but with June of this year it had dropped to 49.9 hours. In the same way the average work week per wage earner declined from 51.4 hours in July, 1914 to 45.4 hours in June, 1924. In connection with the latter figure, it should be remembered that manufacturing activity was considerably below normal in June of this year and consequentiy the average week per wage earner is lower than the normal work-week of this general period.

U. S. Steel Spending for Improvements

The confidence of the U. S. Steel Corp. directors is evidenced by the fact that it is spending approximately $5,000,000 a month for improvements and extensions, according to a statement by Judge Elbert H. Gary.

Judge Gary said: "The iron and steel manufacturers have reason to be pretty well satisfied with the present situation. The business atmosphere, while not as strong and vigorous as at times, is nevertheless comfortable and peaceful.

"Our corporation is making larger expenditures for extensions and improvements than we supposed a few months ago would be necessary or possible. We are spending at the rate of about $5,000,000 a month and our present intentions are to continue this rate for the remainder of the year. This appears to us necessary to take care of business in hand and prospective.

"The railroads are commencing to buy for fall, winter and the next year and they are already placing orders of substantial amount."

British South Africa Buys More Machinery

Exports of industrial machinery from the United States to British South Africa increased 73 per cent in 1923 over the preceding year, according to the Department of Commerce. Of total machinery imports of British South Africa amounting to approximately $9,422,000, America supplied nearly $2,000,000 worth—about one-fifth of the machinery trade.

The George Richards Fund

The Machine Tool Trades Association, England, announces that progress in education is being made by Edward Richards, son of the late George Richards of Geo. Richards & Co., Ltd., Manchester. Additional funds are needed to complete his education and it is hoped that American friends of Mr. Richards may interest themselves in behalf of the son.

Index Now Ready

The index for Volume 60, of the *American Machinist* will be ready for distribution within the next ten days. Copies of this index will be sent upon request being made to this office.

Rarin' to Go!

(Cartoon by courtesy of the New York Herald Tribune)

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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NO BREEZES from unexpected quarters have arisen to ruffle the surface of the business seas and they continue placid. It would be unreasonable to expect the last week of August to bring with it anything exciting, for it is always the favorite vacation time and everyone who can possibly take a holiday does so. The clothing trade is flustered over the arrival of the Prince of Wales with his fifty trunks and is expending much effort and money to discover what they contain on the theory that styles here will be greatly influenced by his taste in clothes, but nothing comparable has happened to arouse any other trade and most people are quietly waiting to see what the early autumn will bring forth.

Nevertheless there is a distinct hopefulness in the air which nearly everybody feels. The Federal Reserve Board is authority for the statement that the decline in production in basic industries has been checked. The steel companies report that August bookings showed an increase of 10 per cent or more over July and this must be reflected in increasing production.

Heavy inroads have been made on accumulated stocks of cotton goods and orders are beginning to find their way back to the mills in fair amounts, so that very active production seems assured once they begin to receive adequate supplies of new crop cotton. Coal mining is due to show its seasonal increase. The automobile manufacturers, having sold most of the surplus cars which they made during the spring, are again beginning to increase their output.

In all these industries, therefore, the peak of unemployment apparently has been passed, and the distributing trades are justifiably confident that increased wage disbursements and the better incomes enjoyed by the farmers will find their way into the markets during the fall and produce excellent business.

It must not be forgotten, however, that a damper will be put upon the expansion if price advances go too high or if they again get out of balance. Many, indeed, think prices of both securities and commodities have already climbed far enough, since they have anticipated better trade rather than resulted from it. For that reason there is a disposition to take profits which has checked the rise in stocks and bonds and held wheat well below its top for the season despite a statistical position which is still strong.

Those who presume to interpret the daily movements of stocks say that having heralded improvement they are now drifting until the improvement materializes. The best bonds have fully reflected the cheapness of money and it is generally conceded that the chance of further speculative profits in them is remote, while if the money markets tighten any more they will go down.

Many profess to see good reasons why money will not become any dearer for many months, but a surplus of any commodity often is converted into a mere sufficiency or an actual deficit in a remarkably short time, as has been demonstrated quite recently in wheat and within easy memory in cotton, sugar and wool. Money is no exception and, while the outlook may appear perfectly safe, there is no good reason why anyone should run the risk of waiting to cover prospective requirements.

The amount borrowed through new bond issues during August was extraordinary for what is usually the dullest month of the year and the total of the European loans for which application will be made in this market is estimated at half a billion dollars, to which must be added Canada's requirements. Not a great deal more of such demands would be required to cause a distinct reversal of our monetary trend, and to them must be added the expanded requirements of American industry if business improves as much as is expected. This caution is admittedly far sighted, and money promises to be abundant and cheap throughout the fall, but I advise that a weather eye be kept on the market.

Copper is steady around 13¼ cents. Steel has not shared in the general price advances, but it is considered to be scraping bottom, and on the whole it may be said that few industries feel they have anything to fear from price declines. This creates a confidence which will undoubtedly be an important factor in the autumn trade and prompts me to repeat my advice that requirements for commodities which are cheap and of which there is a plentiful supply, such as coal and petroleum, should be filled now.

Car loadings during the week ended Aug. 16 made a new high mark for the year. Bank clearings and checks cashed total higher than last year, both in New York and outside. The Federal Reserve statement for the week showed no important changes. More gold was forced into circulation and the reserve ratio declined slightly.

The only uncertainty in the news from Europe has appeared in Germany, where as this was written a vote on the bill embodying acceptance of the Dawes plan was in progress. If the Reichstag should defeat the bill it will probably pay for the act with its political life and the markets are in no way disturbed. Some fear of the competition of a restored Germany is expressed, but she would have to buy as well as sell and if our prices can be kept down such a trade revival in the long run will bring us nothing but profit. It is indeed one of the three constructive influences—the other two being the rise in farm prices, and the ease of money—which should make us all cautiously optimistic.

What's Doing in Industry

After two or three weeks of encouragement, business in the machinery and the machine tool field has declined and the past week shows few sales and a let-up in the inquiries that are being received by dealers. The situation is not without its compensations, however. From the Detroit district comes the report that auto parts makers are receiving good sized orders from automobile builders and that this is the forerunner of increased production in that field—a condition that has been awaited for several months.

Steel production continues to increase, and the price of pig iron has gone slightly higher. Judge Gary took occasion last week to remark that the U. S. Steel Corp. is spending five million dollars a month on improvements and expansions and that business warrants a continuation of this expenditure.

Market conditions generally have remained steady during the week with increased sales reported by retail stores. Prices for commodities have advanced slightly.

Those who follow the stock market for a barometer were mildly disappointed when irregularity set in during the week and some quotations declined. But taken as a unit the market was fairly steady with a reasonable volume of business for the last week in August.

Car loadings for the week ended Aug. 16 were the highest for the year, but still about ten per cent lower than the corresponding week last year.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

Indications of a revival of business in a large number of industries continued to be apparent in Philadelphia this week. Machine and hand tool manufacturers view the situation with hope, each asserting the situation is entirely favorable.

Dealers in small tools, after a careful survey of the present situation, say the indications point to an early revival of business through jobbers, whose stocks are running low. Inquiries among these dealers elicit hopeful information that jobbers will soon be forced into the market as the result of depleted stocks.

Machine tool producers saw nothing in the existing situation to negative their previously expressed hope for an increased activity with the coming of fall. There has been no boom or anything to indicate a boom, nor is such a condition desired. But a healthy economic condition does exist, according to all indications.

The Federal Reserve Bank reports a more active demand for goods, with rising wholesale prices, less curtailing of production, and a slight increase in employment. In the iron and steel industry the bank finds that evidence is abundant that consumption already has made inroads on supplies stored in warehouses, not only in this district but in various other parts of the country as well.

Five completed Baldwin locomotives were sent to Bahia, Brazil, this week, by the Baldwin Locomotive Works. Several hundred tons of locomotive parts were shipped by Baldwin's to Rio de Janeiro and Santos.

Cincinnati

The machine tool situation in Cincinnati shows signs of improvement. While the production has changed but little in the past few weeks, the number of inquiries that are being received and the general tone of the market indicate that the volume of business will probably increase with the opening up of the fall season. Executives are more optimistic than they have been for months. They are taking a sensible view of things and believe that there will be some improvement in sales, although they do not anticipate anything startling. Production at the present time is running along at about forty per cent of normal capacity. Sales are, in most instances, behind those for July and August of 1923, but are not so far behind that increased operations would soon bring the production total on a par with that of last year.

There has been some railroad buying of machine tools in the past week. The railroads are still adhering rigidly, however, to their established policy of purchasing only equipment that is absolutely necessary for replacement purposes. There has been an increase in the business from the automobile manufacturers in the last ten days according to reports from local plants. The inquiries now on hand point to better business from this particular source during the coming month. The general industrial field is responsible for an increase in orders also in local machine tool factories.

Electrical tool houses state that their business has shown an improvement in the last week. The outlook for September is for an increased production of electrical tools. Both July and August have fallen slightly below the same months of 1923.

The used machinery market shows signs of life. There have been a fair number of purchases made and the last two months measure up well compared with the corresponding period of last year. Automobile accessory manufacturers report a slight increase in production. Foundries are operating on a basis of about thirty-five per cent of their normal capacity. Somewhat better inquiry is developing in the iron trade and consumption is on a higher level than was the case a month ago.

Detroit

Fall prospects in the machine tool and machinery lines appear brighter with the arrival of September than at any time during the past few weeks, according to the view held by a large number of machine tool men in Detroit.

Resumption of larger production on the part of the automotive plants, a lessening of the tension which has gripped this section for the past two months, and a brightening outlook on the part of manufacturers everywhere have combined to create an optimistic feeling among the machinery men.

August ranked with normal months in sales, reports indicate, and the steady improvement in freight movements, employment conditions, and steel purchases point toward better business in the fall.

Decrease in stocks held by the automobile factories in various parts of the country portends increased production in Detroit. Automotive executives are getting out into the market for replacements now that the outlook for their business is good, and several local machine tool representatives are experiencing larger orders as a result.

Building operations, considered an index to general business conditions, continue to mount to new levels in Detroit, with many factory extensions being among those included in the totals. Manufacturers are finding the time propitious for alterations to care for expected increased production.

Cleveland

Better business and more inquiries characterize the machinery and machine tool market in Cleveland. Where heretofore there were neither orders nor inquiries, now the consuming element is coming forward seeking information, and, equally important, prices.

This turn for the better, even though actual business is lacking to date, is the result of the efforts of the Cleveland machine tool manufacturers in reaching out after new business through the summer period.

Many of the machine tool manufacturing interests are doing jobbing work.

Prospects in the automatic division are particularly good, especially since response to the publicity being put out by Cleveland plants includes inquiries from hitherto unproductive sources.

In the punch and shear division a larger number of prospective purchasers have come forward in the past two weeks than during any similar period this year. These inquiries are scattered over the country, and appear to call for a wider variety of equipment.

There is a feeling among both manufacturers and distributors here that the turn of the month will bring new business from these sources.

New York

Business did not improve during the past week in the machinery and machine tool field in the New York district, but the encouragement that dealers received by the indications shown during the past month was still evident. The Lehigh Valley R.R. started purchasing on a list recently sent out and it was stated that all of the purchases would be made before another week. The Brooklyn Edison Co. was in the market and bought some machine tools for immediate delivery. Some Western railroads were inquiring in the Eastern markets on good sized lists, but not too much hope was placed in this long distance interest as many thought that the inquiry was made merely for comparative purposes.

Automobile makers were not in the market during the week with either inquiries or purchases, although rumors still persist that buying in the New York market by Eastern automotive interests will commence shortly.

Dealers in used equipment report that business has improved during the week and that the future looks promising. There has been no trouble for these merchants in securing machinery.

Export business is still good and has

been steady during the entire summer. Shipments of road building machinery and concrete mixers were made during the past week.

Buffalo

It is reported that purchases by the Salisbury Axle Co. on account of its new contract for axles for Jewett and Paige cars, which the *American Machinist* predicted a couple of weeks ago, consisted mainly of used machinery, the company finding that there was sufficient equipment of that type offered in the local market to satisfy practically all its needs.

Dealers report that while there still are quantities of used equipment available locally, the large supplies which were placed on the market in the spring have been pretty well depleted and the demand for new machines is therefore strengthening somewhat.

Yet purchases of new machinery for the last two weeks of August were not quiet so active as earlier in the month, and consisted mainly of single orders for varying types of equipment. Also, there are not quiet as many inquiries coming along as was the case earlier. Probably both facts are due to it being the last end of the vacation season when many plant officials who have been unable to get away before take their annual outing.

This condition, however, is variable and some offices report many inquiries, but no large lists on hand.

Several local plants which have been running part time or with only a portion of their usual force are reported as planning to resume full time and capacity operations in September, among them National Aniline & Chemical Co. and the local Ford plant. Pierce-Arrow is still adding to its force and the Sterling Engine Co. is reported to be coming along well. These things make the dealers hopeful for the month ahead.

The only inquiries of size noted this week are for a large turret lathe and a large punch press, amounting to $5,000 or more.

Dealers selling machinery for road and building contractors report some business on truck cranes for road building, but rather light otherwise. There should be a demand for this type of equipment in about a month on account of a number of jobs which will be let in September for completion before winter.

Makers of Auto Parts Speed Up Output

Heavier production schedules reported by manufacturers of automobile parts presages increased activity of the motor car companies in the near future, according to the *Wall Street Journal*.

The Jackson Steel Products Co., Jackson, Mich., this week booked an order for over 70,000 rims for the Hudson Motor Car Co. to be used on Essex cars. Other orders booked, together with prospective business, indicates a busy fall and winter season for this company. During the past week industrial employment in Jackson increased from 349 to 5,898, the gain being almost entirely in the automotive industry.

August shipments of the Continental Motors Corp., from its Detroit plants, are within 10 per cent of the company's peak month, and the September production schedule has been increased over that of August. A Detroit gear manufacturer says the September production schedule will be from 10,000 to 15,000 units ahead of the August schedule, which is 7,000 above the July production.

The Federal Drop Forge Co., Lansing, Mich., is now working 14 of its 18 hammers on local and outside work, and is providing for an increased capacity by the addition of another unit to its plant and the installation of a second die-sinking machine.

Personals

WILLIAM H. ALLEN, formerly with the Kearney & Trecker Corp., Milwaukee, Wis., is now with the Fellows Gear Shaper Co., Springfield, Vt., in the capacity of traveling consulting and sales engineer.

MERCER P. MOSELY, vice-president of the American Exchange National Bank has been elected a director of the Maxwell Motor Corp.

D. M. FRENCH, mechanical engineer of the Gill Railway Supply Co., with headquarters at Peoria, Ill., has been transferred to Chicago.

THOMAS TOWNE has been appointed Eastern sales agent by the Fitzsimons Co., Youngstown, Ohio. Mr. Towne is a member of the Iron and Steel Committee of the Standards Committee of the S.A.E. and was formerly general manager of sales of the Union Drawn Steel Co. of Beaver Falls, Pa. His headquarters will be at 452 5th Ave., New York City.

JOSEPH A. CRAIG, president of the Janesville Machine Co., Janesville, Wis., has been elected president of the newly organized Greater Wisconsin Association, consisting of business men and farmers. The movement is sponsored by the Milwaukee Association of Commerce.

EDWIN HOFSTEDT, for many years conducting the Hofstedt Machine Works at Menasha, Wis., has sold the business to two employees, WILLARD FAHRENKRUG and FRED ROHLOFF. He is now in Takoma, Wash., to establish a new machine shop catering to the sawmill and logging machinery trade.

EARL TRAISE, until recently factory representative for the Panyard Piston Ring Co., Detroit, Mich., has taken charge of a branch of the factory, located at 648 N. Meridian St., Indianapolis. He will control states sales from that office.

J. W. SANGER, trade commissioner of the United States Department of Commerce since 1917, has resigned and will become vice-president of the Foreign Advertising & Service Bureau, Inc., New York.

E. R. GODFREY, who has been connected with the Remy Electric Co., Anderson, Ind., for a number of years as a supervisor and in other capacities, has been named as the new supervisor of Remy Electric plant No. 2 to succeed GRAY H. BERNARD, who has been transferred to the sales division of the company.

CHARLES W. MATHESON has been elected vice-president and director of sales of the Oakland Car Co. Mr. Matheson is also assistant to Alfred P. Sloan, Jr., president of General Motors, Inc., and was formerly vice-president of Dodge Bros.

GEORGE C. BILLMAN has been elected president of the Charles C. Young Manufacturing Co., Jersey Shore, Pa.

Business Items

The Hoover Steel Ball Co., Ann Arbor, Mich., has purchased the Imperial Bearing Co., Detroit. The equipment of the latter plant will be moved to Ann Arbor and housed in the buildings of the Hoover company.

The Briggs & Stratton Co., Milwaukee, manufacturer of automobile accessories, ignition devices, body hardware, etc., has acquired the entire business of the Toledo Automotive Products Co., manufacturing a similar line. The two plants will be consolidated at Milwaukee, and Raymond W. Randall, factory manager of the Toledo concern, joins the Briggs & Stratton Co. in a similar capacity.

The Machinery Equipment Corp., Boston, Mass., is moving from Oliver St. to a larger warehouse and new offices at 5 and 7 Wadleigh Place, Andrews Square, Boston.

The Lake Shore Pattern Works has moved to new quarters at 3,813 and 3,815 E. Ravenswood Ave., Chicago.

The National Grinding Co., 148 E. Woodbridge St., Detroit, has been reorganized with the following officers: W. G. Cook, president; H. M. Lewis, vice-president; Hiram Ash, treasurer; and A. J. Moquin, secretary.

William P. Stein & Co. have moved their plant and office from 282 State St. to 424 St. Paul St., Rochester, N.Y.

The L. V. Davis Engineering Co., South Bend, Ind., has recently added a number of engineering specialists to its staff which brings a total number of engineers now employed by this company up to fifty. The company has recently moved into larger quarters in the Flat Iron Building, corner of Lincoln Way East and Carrol St.

The Baltimore Foreign Trade Service Corp. has been organized under the laws of the state of Maryland. It will act as manufacturers' representative in other countries. The president and manager is John F. Bushnell, formerly with the Du Pont Export Co., Wilmington, Del.

As a step in the liquidation of the Driggs Ordnance & Manufacturing Corp. of New Haven, Conn., the factory plant will be sold at auction, Sept. 5. The New Haven Manufacturing Co., making the New Haven lathe, was the original owner and the Driggs organization began the manufacture of guns for submarine chasers. After the war the company commenced the manufacture of taxicabs.

Standard Steel & Bearings, Inc., expects to resume full time operations at its Plainville, Conn. plant within a few weeks.

The Henry A. Poppert & Son Co., Milwaukee, manufacturer of brass and aluminum castings, patterns, etc., and conducting a machine shop, has purchased the factory building at Fond du Lac, Wis., erected for the former Bull-Dog Tractor Co., and will resume its operation in September.

What the Railroads Are Doing

Directors of the Chesapeake & Ohio Ry. meeting with the boards of the Nickel Plate and Hocking Valley roads authorized the purchase of 2,000 seventy-ton hopper cars and 10,000 tons of heavy steel rails for early delivery to the Chesapeake line.

No action was taken with respect to the Erie and it was stated nothing but routine business came before the Hocking Valley and Nickel Plate board meetings.

The Illinois Central R.R., which recently put out an inquiry for 25 locomotives, has increased it to 50. Of the total 25 are mikado and 25 mountain type.

Ocaranzo Llano, managing director of National Railways of Mexico, has closed a contract with the American Tank Car Co. for 200 broad and 50 narrow gage tank cars, to cost $750,000.

National Railways recently ordered 1,440 freight cars from Standard Steel Car Co. to cost $3,000,000.

Announcement was made that the American Locomotive Co. has booked orders for twelve new locomotives, as the result of the successful experiments with the new three-cylinder locomotive which has been tested successfully on the New York Central and Lehigh Valley Railroads. The orders are from the Pennsylvania R.R. and the Louisville & Nashville R.R., and include one heavy passenger locomotive, one heavy freight locomotive and ten switch engines. Designers of the new three-cylinder type locomotives assert that for a given weight on the driving wheels there can be obtained more power and a steadier pull than is possible with other types of locomotives.

The American Locomotive Works, in conjunction with the Ingersoll-Rand Co. and the General Electric Co., is experimenting with a new locomotive for switching purposes in which a Diesel engine, using oil as a fuel, drives an electric generator, which in turn supplies current to the motors of the locomotive.

The Illinois Central has entered the market for 2,000 box cars, 4,000 gondola cars, 200 stock cars and 200 refrigerator cars.

Henry Ford has been authorized by the Interstate Commerce Commission to construct approximately 56 miles of new line for his Detroit, Toledo & Ironton R.R. at a cost of about $7,500,000. The commission has also authorized the issuance of first mortgage bonds to raise the funds.

The authorization was to the Detroit & Ironton Railroad Co., a subsidiary corporation which Mr. Ford organized to build from Malinta, Ohio, to Dearborn, Mich.

News of the Automotive Industry

July motor vehicle output, according to the Department of Commerce, was 262,876 cars and trucks, against 245,817 in June and 328,105 in July, last year.

July production of the Ford Motor Co. in domestic plants was 151,244 cars and trucks, 5,607 tractors and 664 Lincoln cars. This compares with 169,927 cars and trucks, 9,001 tractors and 782 Lincolns in July, 1923. August operations are on about the same basis.

While many large producers of automobiles were suffering a slump in business during the second quarter of this year, 26 companies, many of them limited producers, either showed gains over the first quarter or held their own in production.

Such companies as Lincoln, McFarland, Haynes, Moon, Cleveland, Stutz, Velie, Peerless all show gains for the second quarter, while Ford, Buick, Studebaker and others showed declines in varying amounts. Dodge, however, gained 3,000.

Mack Trucks, Inc., has authorized to stockholders of record Sept. 2 the right to subscribe to one share of common stock at $80 for each five shares now held. Rights expire Sept. 22. The issue has been underwritten by Hayden, Stone & Co. The purpose of the issue is to supply funds to pay for construction which Mack Trucks is making and to supply working capital for the new large business the company is developing in motor buses and motor rail cars for which there is a growing demand.

The Reo Motor Car Co.'s August sales are 40 per cent ahead of July in volume, but show no gains over August, 1923, except in the export department. Foreign sales increased 10 per cent over last August and with continuous gains maintained the foreign sales will have increased 50 per cent this year over 1923.

The fall promises a heavy demand for Reo speedwagons and this is already being felt in the wheat and cotton producing states.

Reorganization of the Roamer Motor Car Co., and the transfer of the physical assets at Kalamazoo, Mich., to the new Canadian company have been announced by A. C. Barley, president of the Kalamazoo company.

Roamer cars in the future will be built in Canada by the Canadian company incorporated at Toronto, but the new company will continue operation of the Kalamazoo plant at least for the present, and will turn out the Barley Six and execute contracts for taxis with companies in various parts of the United States. The taxi business of this company is reported to be gaining.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Bolt screwing and tapping machine, grinding machine, power hammer or straightening machine, shearing and punching machine, and metal-sawing machine. Melbourne, Australia, Purchase. Reference No. 11,222.

Nail and screw manufacturing machinery. Alexandria, Egypt. Purchase. Reference No. 11,226.

Axles, rear constructions and gear boxes. Brussels, Belgium. Agency. Reference No. 11,289.

Woodworking machines and tools. Leopold Bohrmann. Frankfurt a Main. Germany. Agency.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Sept. 3, 4 and 5. Hotel Sherman, Chicago, Ill. J. A. Duca, C. R. I. & P. Railway, Shawnee, Okla.

International Railway General Foremen's Association. Annual convention, Sept. 9, 10, 11 and 12. Hotel Sherman, Chicago, Ill. William Hall, 1061 W. Wabash Ave., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fourth annual machine tool exhibit, Sept. 15-18. Mason Laboratory, New Haven, Conn. H. R. Westcott, chairman.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

National Safety Council. Thirteenth Annual Safety Congress. Louisville, Ky. Sept. 29 to Oct. 3. W. H. Cameron, managing director, 168 N. Michigan Ave., Chicago.

Motor and Accessory Manufacturers' Association. Annual meeting, Cleveland, Ohio, Week of Oct. 6.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

National Industrial Advertisers Association. Annual meeting, Edgewater Beach Hotel, Chicago, beginning Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

American Gear Manufacturers Association. Semi-annual fall meeting. Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 16, 17 and 18. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City, Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City, Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Iron prices firmer than at any time since the middle of August. Demand still slow in Birmingham district, with buying confined to small tonnage lots. No. 2 fdry grade is $18 per ton, against $25@$27 at this time last year. Considerable improvement is evident in the steel market compared with conditions existing one month ago. Rails and structurals lead in demand. Buying is better in bars, sheets and strip steel. Quotations on principal hot-rolled products are: bars, $210@$215; shapes, $1.95@$2.15 and plates, $1.70@$2 per 100 lb., Pittsburgh. Plates alone show weakness compared with Aug. 22 levels.

Non-Ferrous Metals—Foreign copper prices higher. Tin is steadier at present levels. Lead is also fairly steady. Demand for zinc and antimony quiet, with prices slightly below a week ago. Fabricated brass and copper prices up.

(All prices as of Aug. 28)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.05@22.55
Northern Basic	20.00
Southern Ohio No. 2	21.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.05
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.77@23.27
Virginia No. 2	28.44@29.44
Basic	20.00@21.00
Grey Forge	21.00@22.00
CHICAGO	
No. 2 Foundry local	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.05
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	28.66

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.60@2.70	3.89	3.55	3.80
No. 12	2.70@2.80	3.94	3.60	3.95
No. 14	2.80@2.90	3.99	3.65	4.00
No. 16	3.00@3.10	4.09	3.75	4.10
Black				
Nos. 17 and 21	3.35	4.40	4.25	4.55
Nos. 22 and 24	3.40	4.45	4.30	4.55
Nos. 25 and 26	3.45	4.50	4.35	4.60
No. 28	3.50	4.60	4.45	4.50
Galvanized				
Nos. 10 and 11	3.50@3.60	4.60	....	4.60
Nos. 12 and 14	3.60@3.70	4.70	....	4.70
Nos. 17 and 21	3.90@4.00	5.00	....	5.00
Nos. 22 and 24	4.05@4.15	5.15	5.00	5.15
No. 26	4.20@4.30	5.30	5.25	5.30
No. 28	4.50@4.60	5.60	5.55	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	¾	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50	8.00	6.55
Hoop steel	4.49	3.96@4.36	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.21	3.10
Soft steel bars (base)	3.24	3.11	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.61	3.65
Tank plates (base)	3.34	3.43½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 1/32, 8.35c.; 1/16, 7.85c.; 3/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			52.50
Lead (up to carlots), St. Louis .8@8.12½	New York		8.75
Zinc (up to carlots), St. Louis 6.22½	New York		7.00
	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.10	28.00	28.50
Antimony (Chinese), ton spot	11.50	13.00	10.00
Copper sheets, base	20.62½	20.87½@21.25	23.00
Copper wire, base	19.00	19.00	21.75
Copper bars, base	19.87½	22.25	22.50
Copper tubing, base	22.75	28.00	25.75
Brass sheets, base	17.25	21.75	19.75
Brass tubing, base	21.50	28.00	28.25
Brass rods, base	15.00	17.75	17.50
Brass wire, base	17.75	21.75	20.25
Zinc sheets (casks)	10.60	11.10	....
Solder (½ and ¼), (case lots)	38.50	35.00	30.00
Babbitt metal (83% tin)	60.00	61.75	48@52
Babbitt metal (35% tin)	28.00	18.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	10.75@11.25	....	....
Copper, heavy, and wire	10.50@11.00	....	....
Copper, light, and bottoms	9.25@9.75	....	....
Heavy lead	6.25@6.75	....	....
Tea lead	5.25@5.75	....	....
Brass, heavy, yellow	6.75@7.00	....	....
Brass, heavy, red	8.50@8.75	....	....
Brass, light	5.75@6.00	....	....
No. 1 yellow rod turnings	7.25@7.75	....	....
Zinc	3.75@4.00	....	....

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.00	12.75
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.75	6.55	6.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.14½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	11.50*	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.07	1.16	1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission:			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$6.48
Emery paper	10.71	11.00	8.80
Emery cloth	28.00	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	....	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		4.25@4.75
White lead, dry or in oil	100 lb. kegs	New York, 14.75	
Red lead, dry	100 lb. kegs	New York, 14.75	
Red lead, in oil	100 lb. kegs	New York, 16.25	

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0334	$0.0354
Cold finished shafting	per lb.	0.0415	0.0425	0.0465
Brass rods	per lb	0.1475	0.14	0.1675
Solder (½ and ½)	per lb.	0.385	0.3375	0.295
Cotton waste	per lb.	.14@.21	.14@.21	0.11
Washers, cast iron (⅛ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	0.55	0.55	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	50%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60–10–5%	60%
1½ and 1½x3 in. up to 12 in	15%	.....	....
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	40%	$3.50 net	60%
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3.50 net	60%
Button head bolts, with hex. nuts	10%	List net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	50%	.....	65%
Square and hex. head cap screws	75%	75%	.....
Carriage bolts, up to 1 in. x30 in.	40%	60%	55%
Bolt ends, with hot pressed nuts	50%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4.65
Semi-finished nuts, ⅜ and smaller	70%	.....	.....
Semi-finished nuts, ½ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.75
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	3.75
Washers, round plate, per 100 lb. Off list	1.50	4.50	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	4.00	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	50%	60–10%	70%
Rivets, tinned	50%	60–10%	70%
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.50	$3.50
Cone heads, ditto (net)	5.20	3.60	3.70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	.....

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Bridgeport—Dowling & Co., 94 Wells St., pipe cutter which will take pipe up to 5-in. diameter (used).

Conn., Enfield — School Board — manuel training equipment including metal and woodworking machinery, etc., for new high school.

Ill., Freeport—T. Rockey, 326 E. Washington St.—planer and band saw.

Ill., Saybrook—Saybrook Sheet Metal Works—steel slitting shear.

Ind., Frankfort—Board of Education—manuel training equipment for proposed high and grade school, to cost, $100,000.

Kan., Fort Scott—The Missouri Pacific R.R. Co., Railway Exchange Bldg., St. Louis, W. A. Hopkins, Purch. Agt.—lathes, drills and miscellaneous tools for their machine shops here.

Mass., Boston—Schoolhouse Dept., City Hall—manuel training equipment, including metal and woodworking machinery, etc., for Mather Dist. School.

Mass., Lexington—School Board—manuel training equipment, including metal and woodworking machinery, etc., for new high school.

Mass., Lynn — School Board — manuel training equipment, including metal and woodworking machinery, etc., for new high school.

Mass., Wakefield—School Board—manuel training equipment, including metal and woodworking machinery, etc., for new high school.

Mass., Winchendon — The Toy Town Freezer Co.—pattern lathe with 14 in. swing and 30 in. paper cutter.

Mich., Detroit—Dept. of Street Railways, St. Jean & Shoemaker Aves., F. Meyer, Jr., Purch. Agt.—universal oil grinder, high speed drill, carbonizing oil furnace.

Mich., Ypsilanti—Mobler-Westphal Co., 309 Michigan Ave.—riveting machine, hammer type, capacity ⅞ in. rivet.

Minn., Cloquet—Wood Commission Co., C. E. Hoff, Mgr.,—additional woodworking machinery.

Mo., Kansas City—Board of Education, 9th and Locust Aves.—woodworking machinery, including jig saws, jointers and planers, etc., for manuel training department for new high school.

Conn., Bridgeport—The American Tube & Stamping Co., 471 Hancock Ave., A. Johnson, Purch. Agt.—22 in. continuous billet mill, suitable for rod and bar rolling as well as for strip steel.

N. Y., New York—Triplex Machine Tool Co., 50 Church St., 23 or 24 Bliss knuckle joint embossing press, or an equivalent machine of about 250 tons pressure (used).

Okla., Shawnee—The Chicago, Rock Island and Pacific R.R., La Salle St., Sta., Chicago, Ill., F. D. Reed, Purch. Agt.—new equipment for their machine shop here.

Pa., Philadelphia — Philadelphia Grain Elevator Co., c/o Philadelphia & Reading Ry. Co., at Port Richmond — complete equipment for machine and sheet metal shop.

Pa., Pittsburgh—The National Tube Co., Frick Bldg.—hack saw, drill press, 14 in. lathe, polishing wheels, electric hammer, electric heating furnace, electric melting furnace, travelling crane, low pressure air pump, etc., for proposed research laboratory, Forbes St., Pittsburgh.

Wis., Milwaukee—Central Board of Purchases, City Hall, 1 gap lathe for Riverside Pumping Station.

Wis., Milwaukee—Schroeder Bros., 27th and Forest Home Aves., G. A. Schroeder, Purch. Agt.—additional machine tools, including tool lathe.

N. S., New Glasgow—Nova Scotia Steel & Coal Co., Ltd., machinery and equipment for axle finishing department.

Ont., Almonte—S. S. Edwards, Mill St.—lathe, tire repair outfit, etc.

Ont., Arnprior—J. C. Ward—small lathe, tools, etc.

Ont., Cobdem—J. R. Ross—forge, drill press, etc.

Ont., Pembroke—L. S. Barrand, 121 Lake St.—buzz planer, saw table, rip saw, etc.

Que., Montreal—E. Ste Marie, 426 St. Patrick St.—complete equipment for new public garage and automobile repair shop.

Que., Three Rivers—L. Alaire, 50 Volontaine St.—lathe, drill press and other equipment for automobile and general repair shop.

Opportunities for Future Business

Calif., Emeryville—Hubbard & Co., Sheldon Bldg., San Francisco, awarded the contract for a factory, for the manufacture of pole line equipment, estimated cost, $500,000.

Calif., Los Angeles—Koll Planing Mill Co. will build a 1 story tin can factory pared for the construction of a planing mill, cost will exceed $35,000.

Calif., Modesto—Borden Condensed Milk Co., will build a 1 story tin can factory estimated cost from $40,000 to $60,000. Davis-Heller-Pearce, Delta Bldg., Stockton, Archts.

Calif., San Francisco — City and San Francisco County are receiving bids for the construction of a 1 story car barn and shop addition on 17th St., near Mariposa St., estimated cost, $100,000. M. M. O'Shaughnessy, city engineer.

Conn., Bridgeport—D. W. Flint, Inc., Allens Ave., Providence, R. I., is receiving bids for the construction of a 2 story, 130 x 160 ft. garage and show room on West & State St., estimated cost, $150,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Engrs.

Conn., Norwich—E. C. Ford is having plans prepared for the construction of a 2-story, 60 x 100 ft. repair shop and service garage, setimated cost, $50,000. F. De Grange, 28 Ocean Ave., New London, archt.

La., Gentilly (New Orleans P. O.)—Louisville & Nashville R.R. Co., Louisville, Ky., plans yard improvements, including machine shop, total estimated cost, $600,000. W. H. Courtenay, Louisville, Ky., Chief Engineer.

Me., North Berwick—Berwick Business Corp., c/o G. Dinning, awarded the contract for the construction of a 1 story, 60 x 280 ft. box factory, estimated cost, $60,000. J. E. Richardson, 56 Grove St., Dover, N. H., Archt.

Me., Portland—Clapp Estate, c/o Desmond and Lord, 1 Beacon St., Boston, Archts., are having preliminary plans prepared for the construction of a 2 story repair and service garage, estimated cost, $50,000.

Me., Sanford — Sanford Garage Co., awarded the contract for the construction of a 2-story, 40 x 100 ft. repair and service garage, estimated cost, $100,000. Private plans.

Mass., Chelsea—Standard Box Mfg. Co., Gerrish Ave., awarded the contract for the construction of a 4 story, 50 x 100 ft. addition to plant, estimated cost, $60,000. S. S. Eisenberg, 46 Cornhill St., Boston, Archt.

Mass., South Boston (Boston P. O.)—H. C. Davis, c/o T. F. Rowe, 100 Boylston St., Boston, Archt., plans the construction of a 2 story, 60 x 250 ft. garage, estimated cost, $175,000.

Mass., Worcester—Youngstown Sheet & Tube Co., awarded the contract for the construction of two sheet and bar mills, estimated cost to exceed $40,000. Private plans.

Mich., Detroit — The Everhot Water Heater Co., 214 West Woodbridge St., awarded the contract for the construction of a 1 story, 60 x 200 ft. factory, estimated cost, $40,000. Private plans.

Minn., Cloquet—Wood Commission Co., C. E. Hoff, Mgr., plans the construction of a 2 story, 140 x 180 ft. factory, estimated cost, $100,000. Architect and engineer not selected.

N. Y., Jamestown—J. E. Roberts and Son Co., manufacturer of small machinery, awarded the contract for the construction of a 1 story, 60 x 200 ft. factory, estimated cost $40,000.

O., Cleveland—S. Fix's Sons (Boiler Tube Welding), 1826 Columbus Rd., awarded the contract for the construction of a 1 story, 53 x 70 ft. factory at 1826 Columbus Rd., estimated cost, $40,000. E. E. Smith, Williamson Bldg., Archt.

O., Cleveland—M. Helper, National City Bldg., awarded the contract for the construction of a 2 and 3 story, 50 x 80 ft. factory at 4040 E. Superior Ave., estimated cost, $40,000. Nagle Cabinet Co., c/o Owner, Lessee. G. A. Ebeling, Hunkin-Conkey Bldg., Archt.

O., Cleveland—L. Loveman, 2294 E. 55th St., is receiving bids for the construction of a 2 and 3 story, 180 x 200 ft. garage at 5336 St. Clair Ave., estimated cost, $125,000. H. L. Mangel, 2296 E. 55th St., Archt.

O., Lorain—American Ship Building Co., Wm. H. Gerhauser, Pres., foot of West 54th St., Cleveland, had plans prepared for rebuilding a 1 story, 68 x 100 ft. tin shop, 40 x 83 ft. round house, and 40 x 100 ft. goggler shop, etc., estimated cost, $150,000. Private plans.

Tex., Ewing—Bohlssen Mfg. Co., awarded the contract for the construction of a sawmill, cost $75,000.

Tex., Fort Worth—The Agie Screen Co., Railroad Ave., awarded the contract for the construction of a 1 story, 50 x 200 ft. factory on Summitt Ave., to cost $40,000.

Wis., Milwaukee—G. J. Meyer Mfg. Co., 576 Clinton St., awarded the contract for the construction of a 1 story, 50 x 60 ft. brass foundry, estimated cost, $40,000.

Wis., Racine—Reliance Automatic Lighting Co., 510 College Ave., is receiving bids for the construction of a 2 story, 40 x 60 ft. factory on Mead St., estimated cost, $40,000. A. L. Flegel, 208 Baker Blk., Archt.